RCA VICTOR

TELEVISION SERVICE CLINIC

TECHNICAL ASPECTS OF RCA VICTOR UHF RECEIVING EQUIPMENT

PREPARED BY THE COMMERCIAL SERVICE SECTION
OF RCA SERVICE COMPANY, INC., CAMDEN, N. J.

A Service of Radio Corporation of America

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INTRODUCTION

The RCA Victor Television Service Clinic is a means by which all servicemen can keep abreast of the ever increasing field of television servicing.

The success of our Clinic Program is attributed to the meeting of a demand for comprehensive coverage of television service and installation practices. This demand has been met through the presentation of a series of Service Clinic Lectures, beginning with basic television principles and progressing through UHF television.

Included in the lecture series is service and technical information on RCA Victor television chassis, an up-to-date description of the latest developments in VHF and UHF television.

The lectures, numbered 1 through 9 as listed below, have been compiled to form Television Clinic Lectures—Volume I.

No. 1: *Basic Circuit Description of an RCA Victor Television Receiver.*

No. 2: *Servicing the RCA Victor Television Receiver—The R-F Unit, Picture I-F, and Sound Channel.*

No. 3: *Servicing the RCA Victor Television Receiver—The Video and Sync Circuits.*

No. 4: *Servicing the RCA Victor Television Receiver—Deflection Circuits and Power Supplies.*

No. 5: *Servicing the RCA Victor Television Receiver—Troubles Other Than Component Failures.*

No. 6: *Practical Antenna and Transmission Line Considerations and RCA Victor Television Receiver Installation Techniques.*

No. 7: *Technical Features of the RCA Victor "Million Proof" Television Chassis.*

No. 8: *Technical Features of the RCA Victor KCS66-68 Intercarrier-Sound Television Chassis.*

No. 9: *Introduction to UHF Television.*

The following lecture is available apart from Volume I:

No. 10: *Technical Features and Simplified Alignment of the RCA Victor KCS72-72A Television Chassis.*

The Volume and current Clinic Lectures are available, at a nominal charge, from the RCA Service Company, Inc., Commercial Service Section, Camden, New Jersey.

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FOREWORD

The purpose of this booklet is to provide information on RCA Victor UHF Television Selectors U1, U2, and U70 and the UHF-VHF Tuners KRK-12 and KRK-29A/27. The text deals with the technical aspects of the UHF instruments, antennas, transmission lines, matching devices, installation practices, etc., and is written in the interest of bringing this information to the servicemen associated with RCA Victor Distributors, Dealers and Independent Service Organizations.

THE TEXT OF THIS BOOKLET IS DESIGNED FOR PRESENTATION IN LECTURE FORM AT CLINIC MEETINGS SPONSORED BY THE HOME INSTRUMENT DEPARTMENT OF THE RCA VICTOR DIVISION AND THEIR RCA VICTOR DISTRIBUTORS. THE SERVICE ORGANIZATIONS, AND OTHERS WHO ATTEND THESE LECTURES, HOWEVER, ARE NOT AUTHORIZED TO RENDER TELEVISION SERVICE TO RCA VICTOR TELEVISION RECEIVERS BY MERE ATTENDANCE AT THE CLINIC MEETINGS.

ACKNOWLEDGEMENTS

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Camden, N. J.
February 15, 1953

C. E. WELSHER, Manager
Technical Publications and Service Clinic Group

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TECHNICAL ASPECTS OF RCA VICTOR UHF RECEIVING EQUIPMENT

INTRODUCTION

The addition of 70 UHF channels to the existing 12 VHF channels introduced the problem of adapting the presently operating VHF television receivers to receive the new UHF signals. RCA Victor met this problem through the design and development of three UHF conversion units and a UHF-VHF tuner. The conversion units are called selectors and are designated as U1, U2 and U70. The tuner is designated as the KRK-12 (In kit form as KRK-25).

UHF Selectors

The selectors are used as part of a double-conversion system to convert the UHF signal frequency to the intermediate frequency of the VHF receiver. The first conversion is accomplished within the selector by the use of sections illustrated in the block diagram, figure 1. Shown here are preselector, crystal mixer and local oscillator sections which are used in all three selectors. In addition there are the I-F amplifier and power supply sections which are used only in the U2 and U70 Selectors.

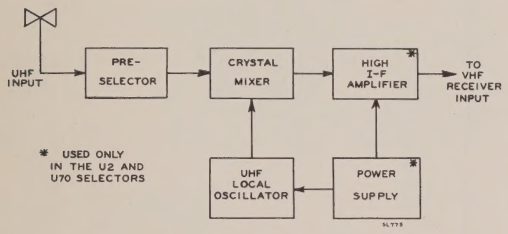


Fig. 1—Block Diagram of UHF Conversion System

The R-F preselector circuits provide selectivity for a choice of any UHF channel. The design of these circuits is such that for the first conversion at the receiver input, channels 5 or 6 may be used.

A crystal diode is used in the mixer stage because of its simplicity of use and good signal-to-noise ratio. Also, the oscillator injection voltage level need not be as high for a crystal mixer as with a vacuum-tube mixer. The crystal mixer is matched to the preselector circuit and to the I-F circuit to keep conversion loss to a minimum.

The local oscillator circuit is designed to operate at a frequency below that of the incoming signal. With this condition the sound and picture carriers remain in the same relative position as they pass through the selector. The sound carrier must remain above the picture carrier until the signal enters the VHF receiver. If the local oscillator operated above the signal frequency, there would be a possibility of having sound and no picture at the receiver output. This would occur as the result of the picture carrier being fed through the receiver I-F amplifiers at the sound carrier position which greatly attenuates the picture carrier in intercarrier receivers. In receivers not using intercarrier sound, the picture carrier would be fed through the sound stages and sound through the picture stages.

An important factor in UHF reception is oscillator drift. This is kept at a minimum by using temperature compensating capacitors in the main tank circuit of the oscillator stage. These capacitors compensate for warm-up drift. Oscillator drift is especially important when the VHF receiver does not use intercarrier sound. Oscillator radiation is kept at a minimum because of the low level of injection voltage required by the mixer stage and by the use of adequate shielding and filter networks.

To help compensate for losses in the input and mixer stages, a wide-band I-F amplifier is used in the U2 and U70 Selectors. These two selectors also contain individual power supplies which make the selectors independent of power from the VHF receiver. An AC power outlet for the VHF receiver is provided in the U2 and U70 Selectors so that the receiver may be energized through the operation of the selector. The U1 Selector obtains its power from the VHF receiver through an adapter cable connected to the receiver audio output tube socket.

UHF-VHF Tuner

The KRK-12 tuner is a sixteen-position rotary type unit which covers both the VHF and UHF television channels. Provision has been made for a maximum of 16 UHF and/or VHF channels through the use of inserts in the tuner drum. A block diagram of the tuner, figure 2, shows the circuits used for VHF and UHF operation.

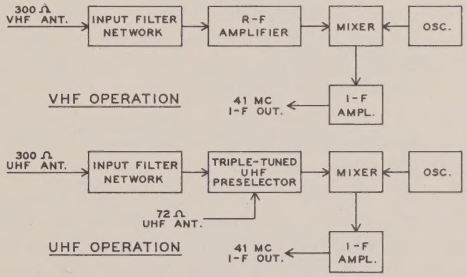


Fig. 2—Block Diagram of KRK-12 Tuner

For VHF operation the R-F signal is amplified, mixed with the local oscillator signal and fed through a stage of I-F amplification. For UHF operation the R-F signal is coupled through a triple-tuned preselector circuit, mixed with the local oscillator signal and fed to the I-F amplifier. A 300-ohm antenna input is provided for VHF or UHF operation and a 72-ohm input is provided for UHF operation.

U1 SELECTOR

Circuit Description

The U1 Selector, figure 3, is a single-channel UHF conversion unit designed primarily for use in areas where only one UHF channel has been assigned. The selector is

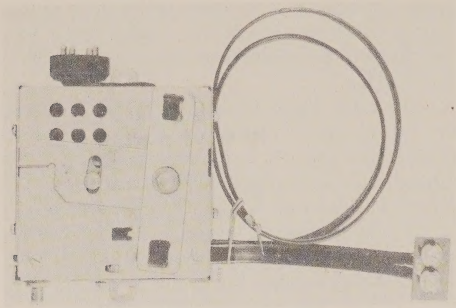


Fig. 3—One Channel UHF Selector—U1

compact in size, 3⅜ inches wide, 3¼ inches high, and 1½ inches deep, and may be mounted on the back of the VHF television receiver. See figure 4. A coaxial jack is provided on the selector for connection of the UHF antenna through an unbalanced 72-ohm line.

The power required for the operation of the selector is obtained from the VHF receiver through a cable the adapter of which is inserted between the audio output tube and the tube socket. Power requirements of the selector are 6.3 volts at 0.23 amperes and 70 volts to 370 volts at approximately 10 milliamperes.

The particular selector, U1A or U1B, that is used is determined by the type of audio output tube socket the television receiver employs. The U1A utilizes a power cable with an adapter for use in a miniature socket (6AQ5) and the U1B, an adapter for use in an octal socket (6K6). Connection of the power cable is made between J2 on the selector chassis and the audio output stage of the receiver chassis. At the receiver, the adapter is plugged into the audio output socket and the audio tube is plugged into the adapter socket.

The power is applied to the selector only when the selector function switch is in the UHF position. In this position the signal output of the selector is fed to the input of the VHF receiver. When the function switch is in the VHF position, the power is removed from the selector and the VHF antenna is connected through the function switch to the receiver for normal VHF operation.

Antenna Input

A 72-ohm antenna input is provided on the selector. The signals are fed through the UHF antenna jack J1 (see figure 5) to the tuned input circuits of the selector. The primary coil of the tuned circuit is tapped to match the 72-ohm input. The tuned circuit inductances, L1 and L2, are printed circuit elements which are tuned to the desired UHF channel by conventional trimmer capacitors, C1 and C3. Both capacitive and inductive coupling are used between the primary and secondary circuits to obtain uniform bandwidth over the UHF band. The secondary circuit inductance, L2, is tapped to match the input impedance of the crystal mixer. Proper matching is thus effected between the antenna and mixer circuits.

Mixer Stage

The mixer stage employs a type CK-710 germanium crystal diode, CR1. This type of crystal is capable of withstanding high inverse voltages and has the peculiar ability of self-healing, in cases where it has broken down electrically. The simplicity of mounting a crystal diode is another factor in favor of its use. The mixer losses are about 9 db. For an intermediate frequency of 82.5 megacycles, the optimum crystal current is between 0.7 and 2.0 ma. depending upon oscillator injection voltage and crystal performance. An I-F of 82.5 mc. is produced when the incoming UHF signal is mixed with the local oscillator signal.

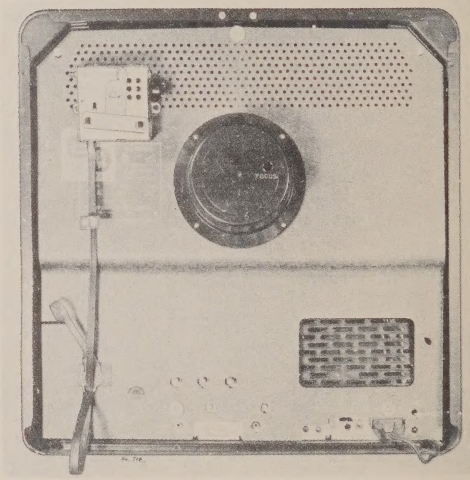


Fig. 4—Installation Location of One Channel UHF Selector—U1

Local Oscillator

A local oscillator signal is generated by V1, a type 6AF4 tube employed in a grounded-plate oscillator circuit. Two ceramic capacitors, C8 and C9, serve to ground the plate of V1 at the oscillator frequency and to compensate for warm-up drift. Inductances (L6, L7 and L8) in the heater and cathode circuits raise the impedance of these elements above ground at the oscillator frequency.

A series resonant circuit between grid and ground forms the oscillator tank circuit. The inductance L9, of the tank circuit, is a short length of coiled bus wire and is tuned by the trimmer capacitor C13. This tank circuit, however, tunes over only slightly more than the lower

half of the UHF television band, channels 14 through 44. In order to tune the oscillator for the remaining channels, 45 through 83, a jumper is placed across L9 to reduce the circuit inductance. The position of the jumper (B) is illustrated in figure 9.

Oscillator plate voltage is obtained through the decoupling network, R2 and C10. The plate circuit also contains a limiting resistor, R6, which is normally jumpered (Jumper A in figure 9) for applied B plus voltages of 295 volts or less. For input voltages greater than 295 volts, the jumper is removed at the time of installation. Other resistor modifications may have to be made in the plate circuit to obtain the necessary voltage of 60 to 90 volts, at the junction of R2 and R6. Complete information is given in the U1 modifications section, page 10, for adapting the selector to input voltages ranging from 80 to 415 volts.

I-F Network

The I-F signal from the mixer is coupled through the low-pass filter consisting of C4, L3 and C5. Circuit design provides a cut-off frequency of 140 megacycles which prevents oscillator radiation to the television receiver. After passing through the filter, the I-F signal is coupled through T1 whose primary function is to transform the impedance from a single-ended input to a balanced 300-ohm output. T1 also offers additional selectivity to block oscillator radiation and minimize interaction of the UHF and VHF oscillators.

The 300-ohm balanced output of T1 is connected through the function switch S1 to the VHF receiver input when S1 is in the UHF position. A tandem connection between S1 and S2 enables plate and heater voltages to be applied to the selector through S2 when S1 is in the UHF position. In this position, normal UHF operation is obtained. When S1 and S2 are placed in the VHF position, the selector is made inoperative, the VHF antenna is connected to the receiver and normal VHF operation results.

Installation and Adjustment

Attachment to the Receiver

The single channel Selector, U1, should be mounted on the rear of the set, close to the antenna input connections (see figure 4). Since there are a number of different types of sets with which this unit may be used, no single procedure for mounting the unit is feasible. Certain factors should be considered however, on all installations, namely, the convenience to operate the switch on the unit, the shortest antenna connections possible, provisions for neat dressing of the power cable and secure mounting.

Power and Antenna Connections

The power cable is equipped with a four-prong receptacle for use on the selector end and an adapter on the receiver end which plugs into the audio output tube socket. The output tube then plugs into the top of the adapter. There are two types of cables, one with an adapter to use in a miniature socket (6AQ5) and the other to plug into an octal socket (6K6).

NOTE: It is important to order the selector which has a cable to fit the particular installation. The designation is: U1A for the miniature type adapter and U1B for the octal type adapter.

The black lead of the power cable is the ground connection. This lead should be connected under any convenient chassis self-tapping screw.

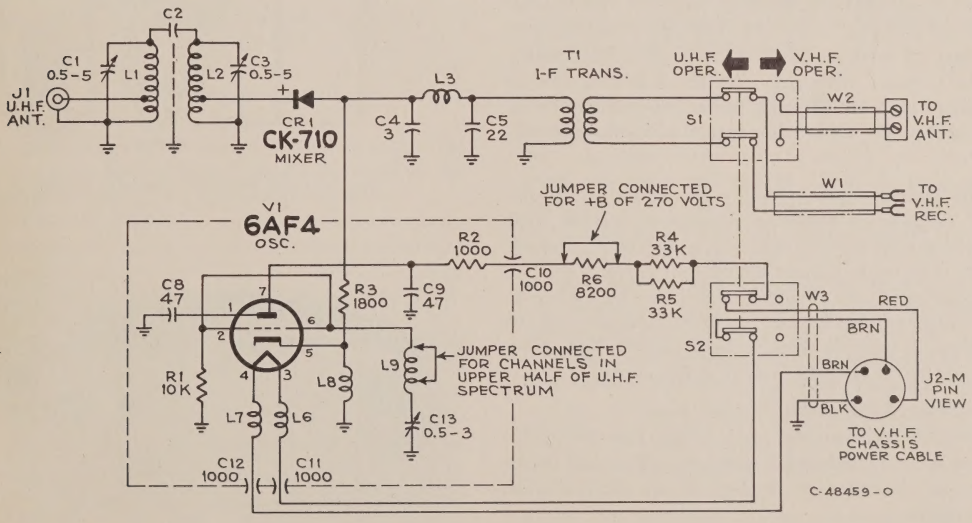


Fig. 5—Schematic Diagram—U1

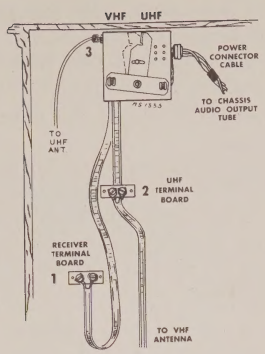


Fig. 6—U1 Antenna Connections for 72 ohm UHF Input

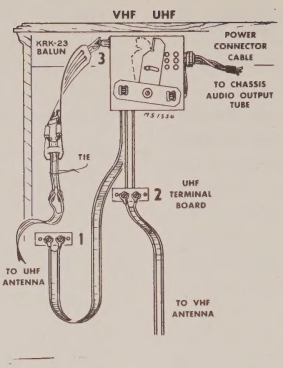


Fig. 7—U1 Antenna Connections for 300 ohm UHF Input

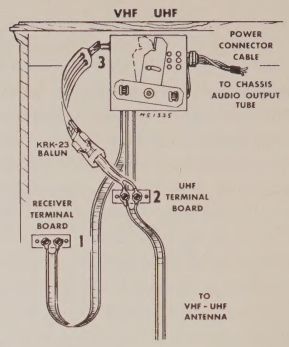


Fig. 8—U1 Antenna Connections for Common UHF-VHF Input

Two lengths of 300-ohm line are attached to the selector. The short line should be connected to the VHF-UHF antenna system and the longer line to the receiver antenna input terminals.

The input impedance of the U1 Selector is 72 ohms. If a 72-ohm coaxial transmission line is used for the installation, a threaded male fitting should be attached to the end of the line and then the line may be connected directly to the UHF antenna input jack. See figure 6.

If a 300-ohm transmission line is to be used for UHF reception, separate from the VHF transmission line, a balun must be employed to match the input impedance. The 300-ohm transmission line is connected to the two-terminal end of the balun and the opposite end, equipped with a coaxial fitting, is conneced to the UHF antenna input jack. See figure 7.

For a common 300-ohm line from the UHF-VHF antenna system, a balun with a high-pass filter must be used as shown in figure 8. The 300-ohm line is connected to the antenna terminal board on the shorter line leading to the selector. The balun with the high-pass filter is connected with the 300-ohm end at this terminal board and the 72-ohm end at the coaxial input to the selector.

NOTE: In cases where a 72-ohm coaxial line is used for VHF reception, a matching transformer must be used between the 72-ohm line and the 300-ohm VHF terminals on the selector. In no case should the 72-ohm VHF line be connected to the 72-ohm coaxial jack on the selector. If the receiver input has been modified from 300 ohms to 72 ohms, it must be changed back to 300 ohms to accommodate the 300-ohm output of the selector.

Adjusting the R-F and Oscillator Circuits

After the antenna and power cables have been connected properly, the unit is ready for adjustment to the particular channel to be received. Follow the procedure as outlined:

IMPORTANT: The oscillator coil L9 is provided with shorting Jumper "B" which is connected in place in a new UHF Selector unit. With this strap in place, the selector will tune from channel 45 through channel 83.

If the channel to be received is below channel 45, Jumper "B" must be clipped and removed. The selector will then tune from channel 14 through channel 44. See figure 9.

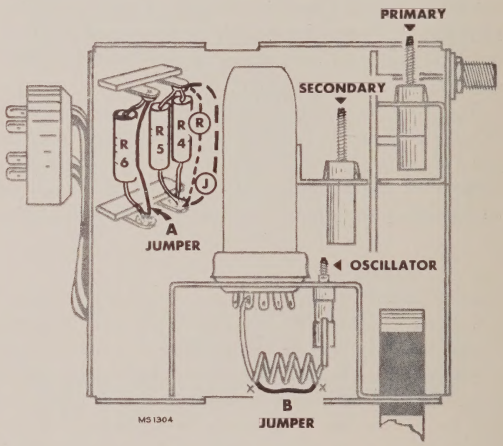


Fig. 9—Cross Sectional View—U1 Selector

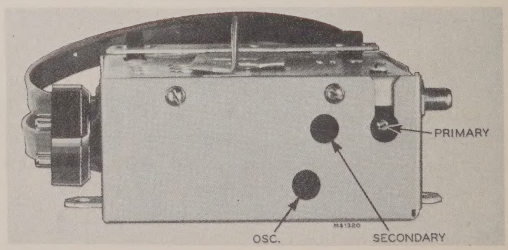


Fig. 10—Top View—U1 Selector

Adjust as follows:

1. Preset the UHF Selector Primary, Secondary and Oscillator adjustments (figure 10) to the approximate locations as indicated in the following table:

Adjustments Corresponding to Channel Number

This tabulation is based on the assumption that the Selector is aligned to 670 mc., the condition in which the unit leaves the factory. CW means clockwise. CCW means counter clockwise.

Channel	*Primary & Secondary*	*Oscillator*
14	6.5 turns CW	1 turn CW
15-16	5.5 turns CW	1 turn CCW
17-19	5.0 turns CW	2 turns CCW
20-23	4.5 turns CW	3 turns CCW
24-27	3.5 turns CW	4 turns CCW
28-32	2.5 turns CW	5 turns CCW
33-37	2.0 turns CW	6 turns CCW
38-41	1.5 turns CW	7 turns CCW
42-44	1.0 turn CW	8 turns CCW
45-46	0.5 turn CW	1 turn CW
47-50	0.5 turn CCW	1 turn CCW
51-54	1.0 turn CCW	2 turns CCW
55-60	1.5 turns CCW	3 turns CCW
61-67	2.0 turns CCW	4 turns CCW
68-75	2.5 turns CCW	5 turns CCW
76-82	3.0 turns CCW	6 turns CCW
83	3.5 turns CCW	7 turns CCW

2. Turn the receiver on and to channel 5 or 6, whichever is unassigned in the operating area. Turn the UHF Selector switch to the UHF operating position. Set the television receiver fine tuning control to the middle of its mechanical range and the volume control clockwise until background noise is heard. Leave the instruments on for at least five minutes before making adjustments to assure stable operation.

3. Adjust the selector oscillator trimmer C13 until sound from the desired UHF station is heard. This adjustment must be made very slowly for it is easy to pass by the proper adjustment point without hearing the sound, particularly if the signal is weak.

4. Once the sound is obtained, adjust the primary trimmer C1 for the best sound and picture. Next, adjust the secondary trimmer C3 for best sound and picture.

5. Readjust the UHF Selector oscillator trimmer so that the best sound and picture occur when the television receiver fine tuning control is in the middle of its range. Repeak C1 and C3 for best sound and picture.

NOTE: In adjusting the UHF Selector oscillator, it may be possible to obtain sound at two positions of the oscillator trimmer adjustment. For proper reception of both sound and picture, the oscillator should be lower in frequency than the station picture carrier. Therefore, if sound is heard in two positions of the trimmer adjustment, the most clockwise position is the correct one. The input circuits to the UHF Selector tune very sharply, particularly the primary. If the UHF signal is very weak, the primary and secondary trimmers C1 and C3 must be in approximately the correct adjustment in order to hear the sound upon adjusting the oscillator trimmer C13.

If it is not possible to hear the sound by the method described above, preset the primary and secondary trimmers one-quarter turn in the same direction from their previous positions and search for the sound by adjustment of oscillator trimmer C13. Repeat this procedure until the sound is obtained.

Under some conditions interfering beats may be obtained between the UHF Selector oscillator and harmonics of the television receiver oscillator which show up as lines in the picture. In some cases the beat may be eliminated by adjusting the receiver fine tuning, then retuning the selector oscillator core for best sound and picture.

Occasionally, adjacent channel interference may be experienced if the VHF signal is strong and the UHF signal is weak. In such cases, it may be desirable to provide a shielded cable between the UHF Selector unit and the television receiver R-F unit.

When it is desired to receive a VHF station on the television receiver, turn the UHF selector switch to the VHF position and operate the receiver normally.

Modifications

The U1A and U1B Selectors will provide satisfactory UHF reception on early-model RCA receivers provided that the proper voltages for operation of the selector can be obtained from the receiver. The U1A and U1B UHF Selectors were designed for use on receivers in which the tube filaments are fed in parallel from a 6.3-volt transformer winding.

CAUTION: Since the black lead of the selector power cable is the ground connection between the receiver chassis and the selector chassis, the U1 series selectors should not be employed with any receiver in which a direct connection exists between the AC power line and the receiver DC power supply.

The plate voltage available from the receiver may not be optimum for operation of the selector as wired. It is very important that between 60 and 90 volts be present at the junction of R2 and R6. This voltage should be measured with a "VoltOhmyst" (or equivalent instrument) with the UHF Selector shield in place. The shield must be in place so that the oscillator will operate normally. Otherwise, with the shield off, the oscillator tank may be detuned to a frequency at which the oscillator will not function and the reading taken will be in error. With the shield in place, voltage measurements can be made through the ventilating holes adjacent to the plate resistors. To obtain proper voltage at R2 and R6, shunt R4, R5 and R6 as necessary with suitable resistors. Use the tabulation provided as a guide.

NOTE: The television receiver operating voltages will not be materially altered by the installation of the UHF Selector.

In some makes of receivers it may be necessary to rewire the adapter socket and cable to suit the particular type of audio output tube. Where filament wiring difficulties are encountered, it may be necessary to remove the adapter socket and wire the power cable into the television receiver. Following is a table which provides information for modification of the U1 Selector for use with various television receivers:

IMPORTANT: Values given apply to RCA Victor Television circuits, with power transformers isolated from the power line and all heaters wired in parallel. With this in mind, the U1 Selector may be used for application to early RCA Victor Models which do not contain line-coupled circuits or series heaters. The U1 Selector should be used *only* under conditions for which designed.

U1 Selector Modification Table

Receiver Plate Voltage	*R6 Jumper*	*R5 & R4 (As Shown)*	*Add Jumper (J) or Resistor (R) (Across R5 & R4)*	*Additional Resistor Modifications*
80	as is	no	(J) Add Jumper	None
150	as is	no	(R) 6.8 K, 0.5 watt	None
185	as is	no	(R) 15.0 K, 1.0 watt	None
190	as is	no	(R) 18.0 K, 1.0 watt	None
200	as is	no	(R) 27.0 K, 1.0 watt	None
220	as is	no	(R) 33.0 K, 1.0 watt	None
230	as is	no	(R) 47.0 K, 0.5 watt	None
235	as is	no	(R) 47.0 K, 0.5 watt	None
245	as is	yes	None req'd	None
250	as is	yes	None req'd	None
265	as is	yes	None req'd	None
270	as is	yes	None req'd	None
290	as is	yes	None req'd	None
295	as is	yes	None req'd	None
335	Clip	yes	None req'd	Add 10.0 K, 0.5 W Across R6
356	Clip	yes	None req'd	None
360	Clip	yes	None req'd	None
415	Clip and remove R6	yes	None req'd	Replace R6 with (2) 33K, 2 watt in parallel

Alignment

No bench alignment is required, as all adjustments of the U1 Selector may be accomplished at the time of installation. Refer to the preceding section on Installation and Adjustment.

Summary

For a location where only one UHF channel can be received, the U1 represents a practical selector unit that can be used with most VHF television receivers. Because the selector depends upon the receiver for power, one of two types of adapter cables is provided with the unit. The model television receiver will determine which selector, U1A or U1B, is used.

All adjustments that are necessary to align the U1 Selector can be made at the time of installation when a UHF station can be received as a signal source. It may be desirable to pre-align the U1 Selector to the desired channel prior to taking it to the place of installation, again using the station as a signal source. This would mean a minimum of time required at the place of installation since only touch-up adjustments would be necessary.

U2 SELECTOR

Circuit Description

In communities where one or two UHF channels are in operation the U2 Selector (see figure 11) can be used in conjunction with a television receiver to receive these channels. A four-position function switch including one "OFF" position provides for a selection between VHF operation and either of two UHF channels. VHF signals are coupled into the selector through a balanced 300-ohm input and UHF signals through a 72-ohm input. The output of the selector is balanced 300-ohm and the signal can be coupled directly to the receiver antenna terminal board through a short length of 300-ohm line.

Included in the U2 Selector are two double-tuned antenna coils and two identical oscillator circuits that provide separate signal paths for each channel up to the mixer stage. The mixer stage, I-F amplifier and output circuits are used alternately by the two channel inputs by switching either channel input to the mixer input. The power for the selector is obtained from a self-contained power supply.

Fig. 11—Two Channel UHF Selector—U2

Antenna Input

The antenna input circuits consist of double-tuned R-F transformers which can be adjusted to the frequency of a UHF channel. Referring to the U2 Selector schematic diagram, figure 12, it is seen that the tuned antenna circuits use tapped inductances which match the input impedances of the UHF antenna and the crystal mixer. The signal input from the UHF antenna is fed through capacitor C5 and function switch S1 to either one of the tuned circuits depending on the switch position. C5 serves to neutralize the inductance of the input lead and thus reduce signal attenuation. In the UHF-1 position of S1, L2-C2 and L4-C4 are coupled to the input and may be tuned to the frequency of one UHF channel. In the UHF-2 position, L1-C1 and L3-C3 are coupled to the input and may be tuned to the frequency of a second UHF channel.

Mixer Stage

The signal at the secondary of either tuned antenna circuit is fed through S1-B to the mixer CR1, a type CK710 germanium crystal diode. At the mixer stage the selected UHF signal beats with the output of the local oscillator to produce an I-F signal response with a bandwidth of 12 megacycles, centered at 82.5 megacycles. A DC path for the crystal diode is provided by L5.

Local Oscillator

Two oscillator circuits are built around V2, a type 6BQ7 twin triode. The two oscillator circuits are identical electrically and mechanically and a description of one will suffice for both. A harmonic type oscillator circuit is employed and the main tank circuit (L9 and C14) is part of a modified Colpitts circuit capable of delivering output frequencies of approximately 195 to 300 megacycles. A harmonic tank circuit (L11 and C18) placed in the cathode circuit, is tunable to either the second or third harmonic frequency of the main tank. This enables the oscillator to provide beat frequencies for all of the channels in the UHF band. A button-type capacitor (C26 or C27), which is in close proximity to the harmonic tank tuning capacitor, couples the oscillator signal from the oscillator to the mixer stage.

In the oscillator plate circuit, L7 functions as an isolation choke to prevent oscillator signal from entering the B plus circuits. C10 is a decoupling capacitor. C12 is a blocking capacitor with a negative temperature coefficient to compensate for oscillator warm-up drift. R6 is the grid-leak resistor and C16 is the coupling capacitor between the main tank and the harmonic tank. In the heater circuit, L13 raises the heater impedance above

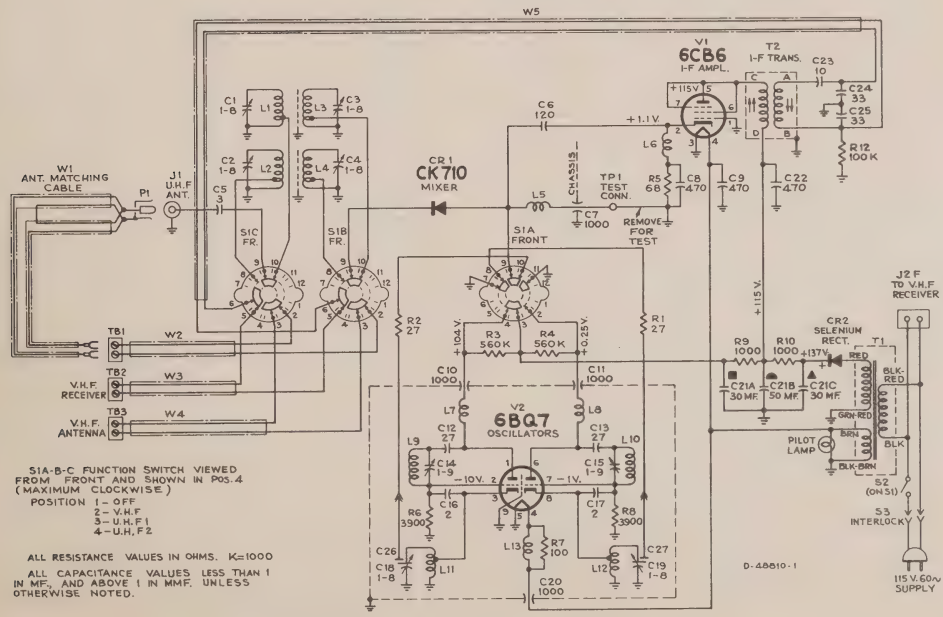


Fig. 12—Schematic Diagram—U2 Selector

ground while R7 flattens the response of L13 over a wide range of frequencies. R2 is inserted between the oscillator and the mixer so that its reactive impedance makes the oscillator voltage injection more uniform over the frequency range of the oscillator.

I-F Amplifier

The I-F signal is coupled through C6 to a grounded-grid amplifier, V1, a type 6CB6 connected as a triode. The output of the amplifier is coupled through T2 which has a 12-megacycle response centered at 82.5 megacycles. Within T2 the impedance is transformed from the single-ended triode impedance to a balanced output, with the aid of capacitors C24 and C25. This network provides a 300-ohm output balanced to ground with C23 reducing the amount of loading on the triode circuit. The 300-ohm output properly matches the input impedance to the television receiver. Figures 13 and 14 show top and bottom chassis views of the U2 Selector.

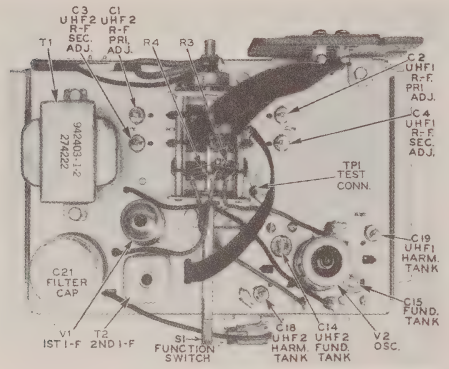


Fig. 13—U2 Top Chassis View

Installation and Adjustment

Antenna Connections

The U2 UHF Selector has been designed to operate from one of three types of antenna installations. It will operate from the VHF antenna, from a separate UHF antenna with 300-ohm transmission line or from a separate UHF antenna with 72-ohm co-axial transmission line. See figures 15, 16 and 17.

In all cases, the VHF antenna transmission line must be disconnected from the VHF receiver and reconnected to the selector VHF antenna terminals. A short length of 300-ohm line must then be connected between the VHF receiver antenna terminals and the selector terminals marked "Receiver."

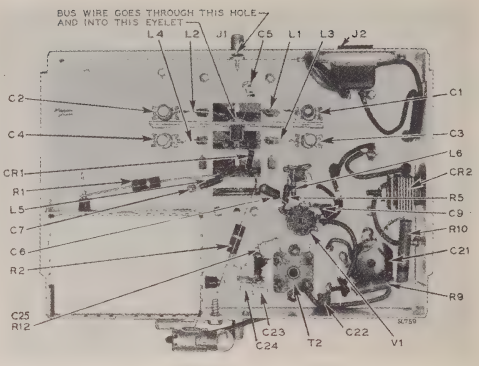


Fig. 14—U2 Bottom Chassis View

NOTE: In cases where a 72-ohm coaxial line is used for VHF reception, a matching transformer must be used between the 72-ohm line and the 300-ohm VHF terminals on the selector. In no case should the 72-ohm VHF line be connected to the 72-ohm coaxial jack on the selector. If the receiver input has been modified from 300 ohms to 72 ohms, it must be changed back to 300 ohms to accommodate the 300-ohm output of the selector.

If the UHF signals from the VHF antenna are strong and free from reflections, the above connections are all that are required. If a separate UHF antenna with 300-ohm transmission line is employed, connect the line to the terminal board marked "UHF." Then, disconnect the 300-ohm line from the UHF terminal board on the inside of the selector.

Make sure that the balun is connected to the terminal board marked "UHF" and is also connected to the selector input jack J1. If a separate UHF antenna with 72-ohm co-axial transmission line is employed, remove the balun from J1, attach a threaded male co-axial fitting to the UHF antenna transmission line and connect it to the selector co-axial input J1. Plug the television receiver power cord plug into the AC receptacle on the back of the selector, and insert the selector power cord plug into the nearest 115-volt AC outlet. With these connections, if the VHF receiver "ON-OFF" switch is left in the "ON" position, both the receiver and the selector will be controlled by the selector switch.

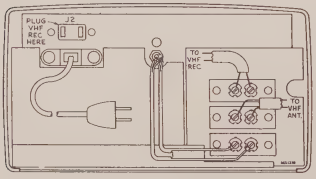


Fig. 15—U2 Antenna Connections for Common UHF-VHF Input

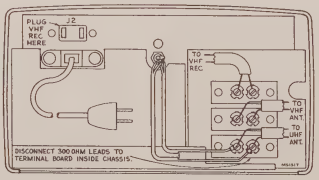


Fig. 16—U2 Antenna Connections for 300 ohm UHF Input

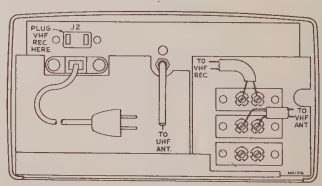


Fig. 17—U2 Antenna Connections for 72 ohm UHF Input

With the selector switch in the UHF 1 position, the selector is operating, the VHF antenna is disconnected from the receiver, the selector output is connected to the receiver and the antenna employed for UHF operation is connected to the selector input. A similar condition exists when the selector switch is in the UHF 2 position.

Adjusting the R-F and Oscillator Circuits

Place the selector on end, as shown in figure 18, with the bottom facing in the same direction as the front of the receiver. This will enable tuning the selector while watching the picture.

To adjust the U2 Selector to the particular UHF stations to be received, connect the antenna, selector and VHF receiver as instructed. Tune the VHF receiver to channel 5 or 6 whichever is unassigned in the receiving area. Set the UHF selector switch to UHF 1. Preset the oscillator tank capacitor C15 and the harmonic tank capacitor C19 as indicated in the table:

Adjustments Corresponding to Channel Number

The adjustments listed in the table below are based on starting the trimmer adjusting screw from the minimum capacity position—the maximum counterclockwise position. (CW—clockwise.)

UHF Channel	*OSC Tank C14 or C15*	*Harmonic Tank C18 or C19*
14-16	13.0 turns CW	12.5 turns CW
17-19	11.5 turns CW	11.5 turns CW
20-22	10.25 turns CW	10.25 turns CW
23-25	9.0 turns CW	9.5 turns CW
26-28	8.25 turns CW	8.5 turns CW
29-31	7.25 turns CW	7.75 turns CW
32-34	6.25 turns CW	7.0 turns CW
35-37	5.5 turns CW	6.5 turns CW
38-40	4.75 turns CW	6.25 turns CW
41-43	4.25 turns CW	5.75 turns CW
44-46	3.5 turns CW	5.25 turns CW
47-49	13.0 turns CW	5.0 turns CW
50-52	12.25 turns CW	4.75 turns CW
53-55	11.25 turns CW	4.25 turns CW
56-58	10.5 turns CW	4.0 turns CW
59-61	9.5 turns CW	3.5 turns CW
62-64	9.0 turns CW	3.25 turns CW
65-67	8.25 turns CW	3.0 turns CW
68-70	7.75 turns CW	2.75 turns CW
71-73	7.0 turns CW	2.5 turns CW
74-76	6.5 turns CW	2.25 turns CW
77-79	6.0 turns CW	2.0 turns CW
80-83	5.5 turns CW	1.75 turns CW

Disconnect the balun matching stub from the input jack J1. Temporarily connect the UHF antenna directly to the crystal CR1 as follows: Connect a bus wire (a paper clip, straightened out, is very useful here) to the center conductor of the balun connector P1. Insert the other end of the bus wire 1½ inches straight into the ¼ inch hole directly below J1 on the selector chassis rear apron. Make contact with the center of the black eyelet terminal. See figure 14. Using an insulated slotted tuning stick, adjust C15 slightly until sound is heard, then retouch C15 and C19 for best sound and picture with minimum interference.

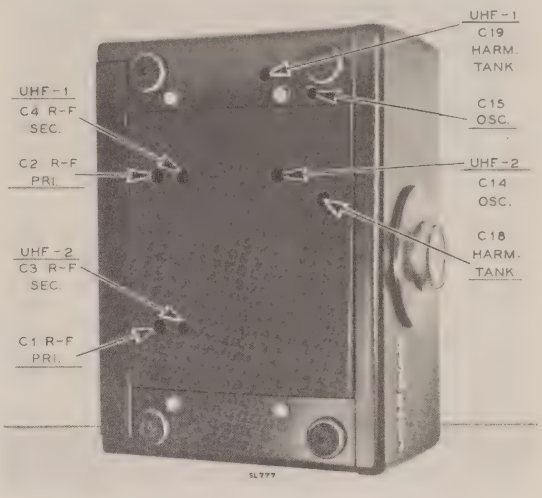


Fig. 18—U2 Adjustment Locations

Remove the bus wire (or paper clip) from the terminal and the balun and reconnect the balun to J1. Starting with C2 and C4 at minimum capacity (maximum counterclockwise) turn both trimmers to obtain the best sound and picture. To adjust the U2 UHF Selector for a second channel, rotate the selector switch to UHF 2. Preset the oscillator capacitor C14 and the harmonic tank capacitor C18 as indicated in the table on the opposite side of the page. Connect the antenna to the crystal as before. Tune C14 slightly until sound is heard, then adjust C14 and C18 until best sound and picture, with minimum interference, are obtained. Then reconnect the antenna to J1 and tune C1 and C3 for best sound and picture.

NOTE: For proper reception, the oscillator harmonic employed for conversion must be lower in frequency than the UHF station. If two slightly different positions of the oscillator core produce sound from the desired station, the most clockwise position is the correct one.

In tuning one oscillator it is possible that the oscillator tank of the circuit not in use may be tuned to the same frequency. If this occurs the second oscillator tank may act as a trap, absorbing energy from the first oscillator and causing poor operation. In such a case, detune the second oscillator tank until the first oscillator circuit is no longer affected. Once adjusted for the proper channels no difficulty should be experienced from this source as it is extremely unlikely that both oscillators would be operating on the same frequency. When properly aligned, the crystal current should be approximately 0.75 ma. for best signal-to-noise ratio. The current can be

measured by disconnecting the test link on top of the chassis and inserting a 0-5 ma. meter between the link and ground.

The oscillator tube or the crystal should be suspected if this current reading is not obtained. If these two components are found to be in good condition, and no other oscillator or mixer circuit components are found defective, the correct current reading can be obtained by re-adjusting the oscillator injection capacitors, C26 and C27. These adjustments are described under "Checking the R-F Circuits," page 14.

The oscillators in the U2 Selector operate in the 195-mc. to 300-mc. range. The oscillator signal applied to the crystal mixer is taken from a harmonic tank in the oscillator circuits. The usual practice is to employ the oscillator second harmonic signal for reception of channels 14 through 46 and the third harmonic signal for reception of channels 47 through 83.

Alignment

The following test equipment is required for the alignment of the U2 Selector:

A VHF sweep generator with a range of 70 mc. to 90 mc.

A VHF marker generator which supplies 76.5 mc., 82.5 mc., and 88.5 mc. signals.

An oscilloscope with a high-gain vertical amplifier.

A milliammeter with a 0-5.0 ma. range.

A resistive pad for terminating the sweep generator cable.

A 300-ohm balanced detector.

I-F Circuits

1. Construct a 300-ohm balanced detector as shown in figure 19 and connect it to the UHF selector terminal board marked "Receiver" (TB2). Connect a high-gain oscilloscope to the balanced detector and set the gain to maximum. Refer to figure 21.

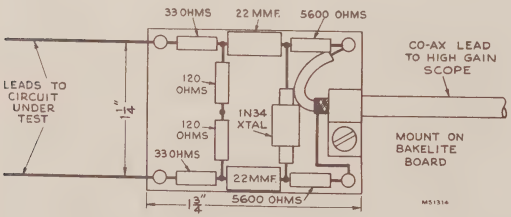


Fig. 19—300 ohm Balanced Detector

2. Connect an attenuator pad of the type shown in figure 20A to the output cable of the VHF sweep generator. Connect the output of the attenuator pad through a 470-mmf. ceramic capacitor to the cathode, pin 2 of V1.

3. Set the sweep generator to sweep from 70 mc. to 95 mc. As an alternate method, when using the RCA type WR59 sweep generator, switch the generator to channel 5 to see the low frequency side of the response curve and to channel 6 to see the high frequency side of the response curve.

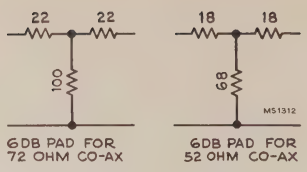


Fig. 20A—Sweep Attenuator Pads

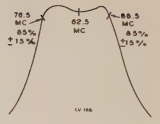


Fig. 20B—U2 I-F Response

4. Insert markers from a VHF marker generator by loosely coupling the generator output cable to the cathode, pin 2 of V1.

5. Adjust the primary and secondary cores of T2 until the response shown in figure 20B is obtained.

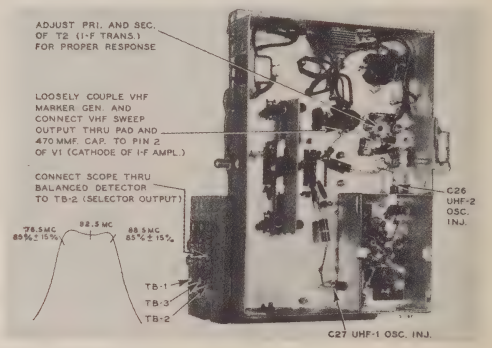

ADJUST PRI. AND SEC. OF T2 (I-F TRANS.) FOR PROPER RESPONSE
LOOSELY COUPLE VHF MARKER GEN. AND CONNECT VHF SWEEP OUTPUT THRU PAD AND 470 MMF. CAP. TO PIN 2 OF V1 (CATHODE OF I-F AMPL.)
CONNECT SCOPE THRU BALANCED DETECTOR TO TB-2 (SELECTOR OUTPUT)
C26 UHF-2 OSC. INJ.
78.5 MC 85% ± 15%
82.5 MC
88.5 MC 85% ± 15%
TB-1
TB-3
TB-2
C27 UHF-1 OSC. INJ.

Fig. 21—U2 I-F Alignment Connections and Adjustments

Checking the R-F Circuits

1. Adjust the selector for the reception of 2 UHF stations as described under Installation and Adjustment, page 12.

2. Connect a 0-5 ma. meter to the crystal by opening the test connection on top of the chassis and connecting the meter in series with the test connection and ground.

3. The crystal current should closely approximate 0.75 ma. on each channel. The oscillator injection trimmers were set at the factory to produce this value of current. However, if it should become necessary to readjust the oscillator injection, this may be done by adjusting capacitors C26 and/or C27.

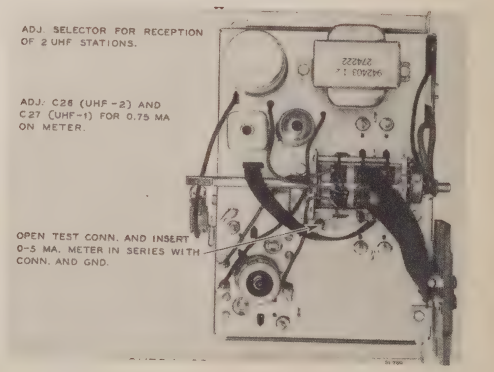

ADJ. SELECTOR FOR RECEPTION OF 2 UHF STATIONS.
ADJ. C26 (UHF-2) AND C27 (UHF-1) FOR 0.75 MA ON METER.
OPEN TEST CONN. AND INSERT 0-5 MA. METER IN SERIES WITH CONN. AND GND.

Fig. 22—U2 Check of R-F Circuits

4. These capacitors resemble large metal headed tacks and are mounted in a feed-through bushing in the wall of the oscillator compartment. Adjustment is effected by sliding the head towards or away from the harmonic tank capacitor, C18 or C19. To prevent the adjustment from changing, the body of the tack is soldered in place.
5. The measurement of crystal current should be made with the selector adjusted for reception of a station but with no signal input and with the oscillator compartment bottom shield in place. Do not adjust the injection to compensate for a defective crystal or oscillator tube.

Summary

The U2 Selector can be used in areas where either one or two UHF channels can be received. A self-contained power supply makes this selector independent of the model television receiver with which it is used. Good signal-to-noise and gain characteristics of the selector make it adaptable to a wide area of reception.

The R-F and oscillator stages of the U2 Selector can be adjusted when receiving a UHF station provided that the I-F stage is not out of alignment. If misalignment is encountered, the I-F stage should be aligned by using, standard VHF sweep and marker generator signal sources. When this is completed, the R-F and oscillator stages can be aligned "on the air."

The installation and field alignment adjustments of the U2 Selector should present no problem if the procedures are followed as outlined and care is exercised when making adjustments. It should be emphasized that these adjustments are critical and that techniques which work well when adjusting VHF equipment may not be applicable to UHF equipment. A rapid adjustment of a core or trimmer may lead to tuning past the operating point without a noticeable indication of sound or picture. Another point to be remembered, in regard to the oscillator adjustments, is that the oscillator output frequency has to be lower than the frequency of the channel received, in order that the sound and picture carriers remain in the same relative position as they pass through the selector. Therefore, if two positions of the adjustment result in sound or picture indication, the lower frequency or most clockwise position of the adjustment is correct. The antenna connections to the selector are straightforward and should cover most of the types and combinations of transmission line inputs.

U70 SELECTOR

Circuit Description

The U70 Selector shown in figure 23 is a continuous-tuning type of UHF selector unit which is capable of receiving all channels in the UHF band. The selector is housed in a wooden cabinet and may be placed on top of, or adjacent to, the VHF television receiver. All circuits in the selector operate from a self-contained power supply which is energized from a 115-volt, 60-cycle input.

The type of operation, VHF or UHF, is determined by a three-position function switch, indicating "OFF,"

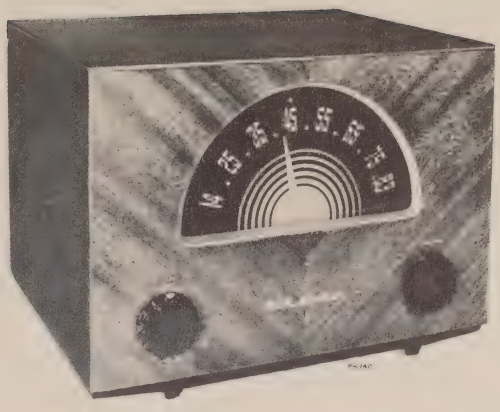


Fig. 23—All Channel UHF Selector—U70

"VHF" and "UHF." The left-hand knob controls this switch. In "VHF" position, the VHF antenna is connected through the switch to the VHF receiver input and the selector is placed in a stand-by condition. In "UHF" position, the UHF antenna is switched to the input of the selector. The output of the selector is now fed to the VHF receiver. The selector output is balanced 300-ohm which properly matches the input to the television receiver.

Power requirements of the selector are fulfilled by the self-contained power supply which uses a 5Y3-GT tube in a full-wave rectifier circuit. The B plus voltage is adequately filtered and decoupling networks are employed in the B plus leads of each stage. The limiting resistor (R9) is shorted by S1B when S1 is in the UHF position. In the VHF position, R9 serves to place the selector in a stand-by condition. J3F is a power outlet for the VHF receiver and both the selector and the receiver are energized through the operation of the function switch on the selector.

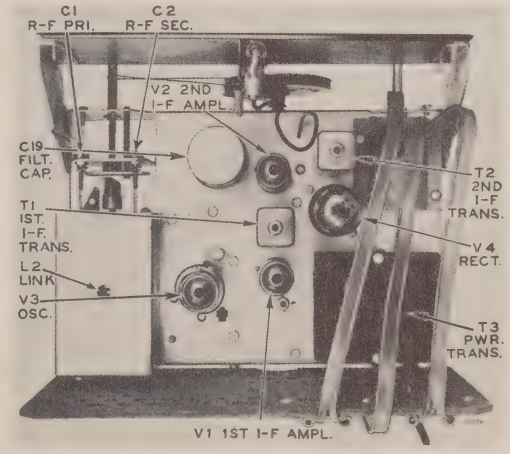


Fig. 24—U70 Top Chassis View

Antenna Input

Signal from the UHF antenna enters the selector at J1 (see figure 25) and is coupled by a short length of 72-ohm coaxial line to the tuned antenna circuit. The primary coil, L1, of the tuned circuit is tapped to match the 72-ohm input. L1 and the tuning capacitor, C1, form a series-tuned circuit which is tuned to the frequency of the desired UHF channel. The secondary coil, L3, and the tuning capacitor, C2, form a similar circuit. A variable link, L2, inductively couples the primary and secondary coils and determines the amount of bandwidth for the tuned circuit. L3 is tapped to match the input impedance of the crystal mixer.

Mixer Stage

The mixer, CR1, is a type 1N82 silicon crystal diode which mixes the UHF signal with that of the local oscillator to produce an I-F signal of 82.5 megacycles. The oscillator injection voltage is kept uniform over the UHF band by the variation of impedance across R1 and C3.

The crystal current can be measured at J2 and, under normal operating conditions, should read between 0.7 and 2.0 milliamperes. L4 provides a DC path for this current.

Local Oscillator

The local oscillator, V3, employs a type 6AF4 tube in a modified Colpitts circuit. L9 and L11 may be considered as a form of transmission line with capacitive termination at C18. This network, in conjunction with C15, C16 and the plate-to-grid capacitance of V3, forms the oscillator tank circuit. L9 and C18 are varied in tandem to change the L-C combination of the tank. L9 is made variable to extend the tuning range to cover the UHF band. C18 has a specially shaped brass core to make the tuning linear over the UHF range. C15 and C16 have negative temperature coefficients which compensate for warm-up drift. L10, in the plate circuit, L8, in the cathode circuit, and L6 and L7, in the heater circuit, are isolation chokes which raise the impedance to ground of these elements at the frequency of oscillation.

I-F Amplifier

The I-F signal from the mixer is coupled through two stages of amplification, (one) the grounded-grid amplifier V1 which uses a type 6CB6 connected as a triode and (two) the pentode amplifier V2 which uses a type 6CB6 to increase the signal level.

V1 is biased by R2 and C6 to prevent overload. L5 is tuned to resonate with the circuit capacity at the intermediate frequency. C5 is a coupling capacitor which also neutralizes the inductance of the input lead to the cathode. C20 lowers the impedance of the cathode input circuit. T1 and T2 are double-tuned coupling transformers, resonant at 82.5 megacycles. The coefficients of coupling and thus the bandwidth of T1 and T2 are adjustable through C21 and C22, respectively. C21 and C22 consist of ceramic tubes into which short pieces of wire have been inserted. A variation in capacity is effected by a variation of wire insertion.

T2 converts from the single-ended pentode impedance to a balanced 300-ohm impedance with the aid of capacitors C12 and C13 which balance the output to ground. C11 reduces the loading effect of the output circuits on the pentode stage. The 300-ohm output is connected to the VHF receiver input through the function switch S1, when S1 is in the UHF position.

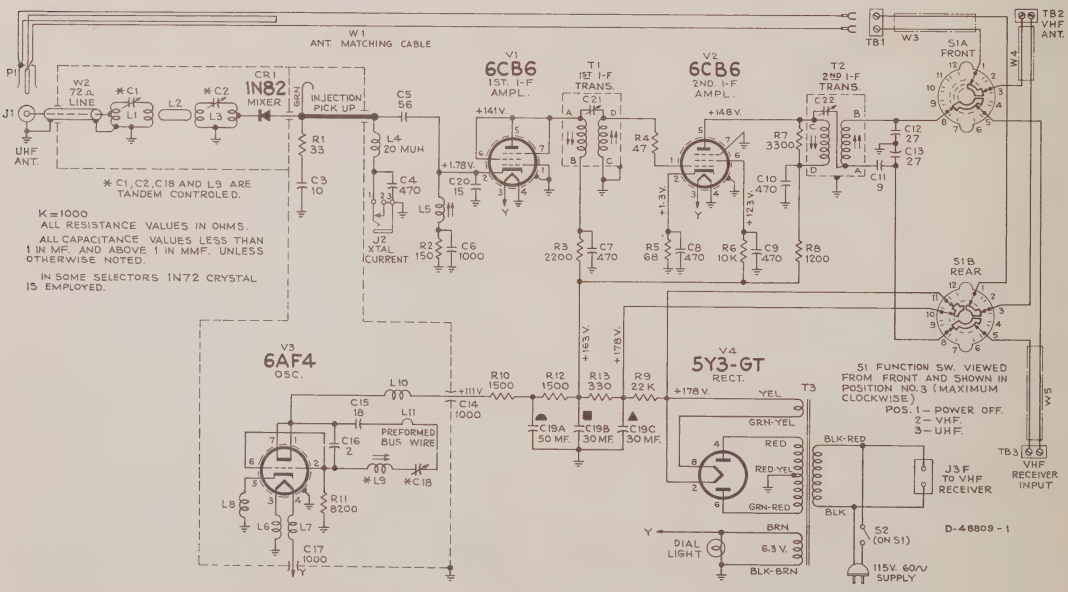


Fig. 25—Schematic Diagram—U70

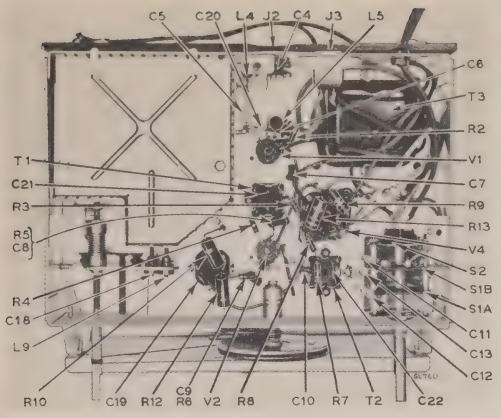


Fig. 26—U70 Bottom Chassis View

Installation

The U70 Selector has been designed to operate from one of three types of antenna installations. See figures 27, 28 and 29. In all cases, the VHF antenna transmission line must be disconnected from the VHF receiver and reconnected to the selector VHF antenna terminals. A short length of 300-ohm line must be connected between the VHF receiver antenna terminals and the selector terminals marked "Receiver." If the UHF signals from the VHF antenna are strong and free from reflections, the above connections are all that are required.

If a separate UHF antenna with 300-ohm transmission line is employed, connect the line to the selector terminal board marked "UHF." Then, disconnect the 300-ohm line which runs from this terminal board over the fiber back and into the selector. Tape the ends of these leads so that they will not short other terminals on the back and cause trouble.

If a separate UHF antenna with 72-ohm coaxial transmission line is employed, remove the balun, attach a threaded male coaxial fitting to the antenna transmission line and connect it to the jack on the selector rear apron.

NOTE: In cases where a 72-ohm coaxial line is used for VHF reception, a matching transformer must be used between the 72-ohm line and the 300-ohm VHF terminals on the selector. In no case should the 72-ohm VHF line be connected to the 72-ohm coaxial jack on the selector. If the receiver input has been modified from 300 ohms to 72 ohms, it must be changed back to 300 ohms to accommodate the 300-ohm output of the selector.

Insert the television receiver power cord plug into the AC receptacle on the back of the selector and insert the selector power cord plug into the nearest 115-volt AC outlet. With these connections, if the VHF receiver "ON-OFF" switch is left in the "ON" position, both the receiver and the selector will be controlled by the selector function switch.

With the selector function switch in "VHF" position, the receiver is turned "ON," the selector is "ON" but in stand-by condition and the VHF antenna is connected to the receiver. With the switch in "UHF" position, the selector output is connected to the receiver and the antenna employed for UHF operation is connected to the selector input.

Alignment

Alignment of the U70 Selector can be accomplished through the use of the following test equipment:

A UHF sweep generator with a range of 470 mc. to 890 mc.

A VHF sweep generator with a range of 70 mc. to 90 mc.

A UHF marker generator for locating 480, 630 and 840 mc.

A VHF marker generator capable of supplying 72.5-mc., 76.5-mc., 82.5-mc., 88.5-mc. and 92.5-mc. signals.

An oscilloscope with a high gain vertical amplifier.

A milliammeter with a 0-5 ma. range.

A resistive pad for terminating the sweep generator cable.

A 300-ohm balanced detector.

NOTE: The availability of UHF test equipment may warrant alternate methods of alignment other than those presented in this section. A strong signal from a UHF station may be used to align the R-F or the oscillator stages if one or the other of these stages is still in alignment.

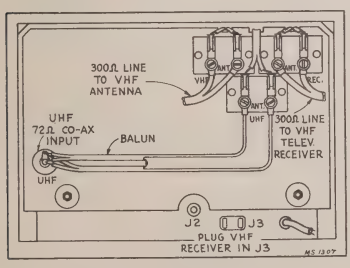


Fig. 27—U70 Antenna Connections for Common UHF-VHF Input

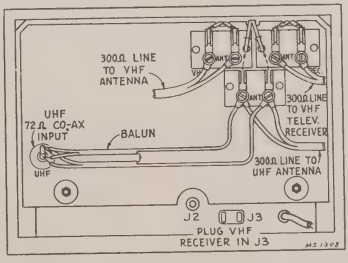


Fig. 28—U70 Antenna Connections for 300 ohm UHF Input

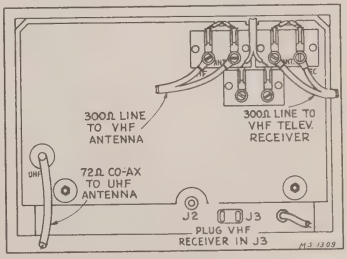


Fig. 29—U70 Antenna Connections for 72 ohm UHF Input

I-F Circuits

SECOND I-F STAGE—1. Construct a 300-ohm balanced detector as shown in figure 19 and connect it to terminal board TB3. Refer to figure 30.

2. Connect a high-gain oscilloscope to the balanced detector and set the gain to maximum.

3. Connect a 72-ohm attenuator pad of the type shown in figure 20A to the output cable of the sweep and connect the output of the pad to the grid, pin 1 of V2 and to ground.

4. Set the sweep generator to sweep from 72 mc. to 90 mc. As an alternate source, an RCA WR59 sweep generator may be employed and switched to channel 5 to see the low frequency side of the response curve and to channel 6 to see the high frequency side of the response curve.

5. Insert markers from the VHF marker generator by loosely coupling the generator output cable to the grid of V2.

6. Adjust the T2 primary and secondary cores and the bandwidth trimmer C22 to obtain a response as shown in figure 30.

The bandwidth capacitor C22 (and C21 in T1) consists of a short piece of wire soldered to terminal A with the free end inserted into a ceramic tube capacitor. Adjustment is made by pushing the wire further in or pulling it out.

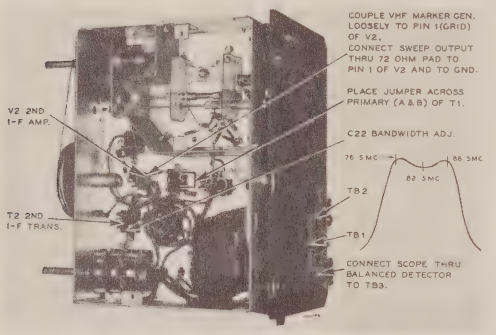

COUPLE VHF MARKER GEN. LOOSELY TO PIN 1(GRID) OF V2, CONNECT SWEEP OUTPUT THRU 72 OHM PAD TO PIN 1 OF V2 AND TO GND.
PLACE JUMPER ACROSS PRIMARY (A & B) OF T1.
C22 BANDWIDTH ADJ.
V2 2ND I-F AMP.
T2 2ND I-F TRANS.
TB2
TB1
76.5 MC
82.5MC
88.5MC
CONNECT SCOPE THRU BALANCED DETECTOR TO TB3.

Fig. 30—U70 2nd I-F Alignment Connections and Adjustments

FIRST I-F STAGE—1. Remove the jumper from terminals A and B of T1 and reconnect it across terminals A and B of T2. See figure 31.

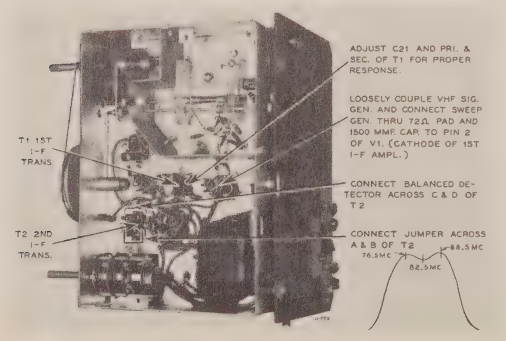

ADJUST C21 AND PRI. & SEC. OF T1 FOR PROPER RESPONSE.
LOOSELY COUPLE VHF SIG. GEN. AND CONNECT SWEEP GEN. THRU 72Ω PAD AND 1500 MMF CAP. TO PIN 2 OF V1. (CATHODE OF 1ST I-F AMPL.)
T1 1ST I-F TRANS.
CONNECT BALANCED DETECTOR ACROSS C & D OF T2
T2 2ND I-F TRANS.
CONNECT JUMPER ACROSS A & B OF T2
76.5MC
82.5MC
88.5MC

Fig. 31—U70 1st I-F Alignment Connections and Adjustments

2. Connect the balanced detector across T2, terminals C and D.

3. Connect the output cable of the sweep generator with the 72-ohm pad through a 1,500-mmf. capacitor to pin 2 of V1.

4. Connect the VHF marker generator loosely to pin 2 of V1.

5. Adjust the T1 primary and secondary cores and the bandwidth trimmer C21 to obtain the response shown in figure 31.

OVERALL I-F RESPONSE—1. Leave the sweep generator connected to the cathode of V1. Refer to figure 32.

2. Remove the jumper across terminals A and B of T2.

3. Connect the balanced detector across terminal board TB3.

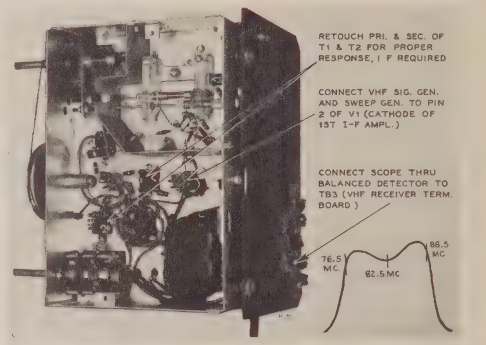

RETOUCH PRI. & SEC. OF T1 & T2 FOR PROPER RESPONSE, I F REQUIRED
CONNECT VHF SIG. GEN. AND SWEEP GEN. TO PIN 2 OF V1 (CATHODE OF 1ST I-F AMPL.)
CONNECT SCOPE THRU BALANCED DETECTOR TO TB3 (VHF RECEIVER TERM. BOARD)
76.5 MC.
82.5MC
88.5 MC

Fig. 32—U70 Overall I-F Alignment Connections and Adjustments

4. The overall I-F response should appear as shown in figure 32. The oscilloscope gain should be kept at a maximum and the input kept low to prevent overloading the selector. If excess tilt of the curve is present, retouch the T1 and T2 primary and secondary cores until the curve is reasonably flat.

R-F and Oscillator Circuits

If the selector needs only touch-up adjustments, no presetting of the tuning cores is required. However, if the selector is completely out of alignment the tuning cores should be preset as follows:

1. With the dial drive mechanism 1¼ turns from the low frequency stop (channel 14 end of the dial), set the C18 oscillator tuning core as shown in figure 33A. The cores of the R-F tuning capacitors C1 and C2 should be set as shown in figure 33B. The tapered end of the L9 core should be set about ¾ of an inch from the closest end of the L9 coil as shown in figure 33C.

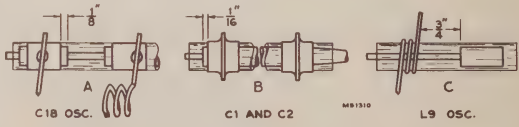


Fig. 33—Preset for R-F Adjustments

2. Turn the dial drive mechanism until it comes up against the stop at the low frequency (channel 14) end of the dial.

3. Turn the dial pointer on its shaft until the pointer coincides with the end marker on the dial back plate.

4. Turn the dial drive mechanism until the pointer is 17 degrees to the left of center of the dial when the selector is sitting in an upright position. This position should be located with a protractor to insure accuracy.

5. Make a small mark on the dial back plate so that the dial can be returned to this position quickly and accurately throughout the remainder of the alignment procedure. This is the 630-mc. calibration point.

6. Connect the 300-ohm balanced detector across terminals A and B of T1 and shunt a 1,000-ohm resistor across terminals C and D of T1. See figure 34.

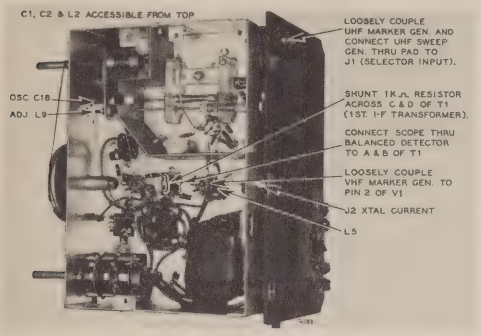

C1, C2 & L2 ACCESSIBLE FROM TOP
LOOSELY COUPLE UHF MARKER GEN. AND CONNECT UHF SWEEP GEN. THRU PAD TO J1 (SELECTOR INPUT).
OSC C18 ADJ.
L9
SHUNT 1K Ω RESISTOR ACROSS C & D OF T1 (1ST. I-F TRANSFORMER).
CONNECT SCOPE THRU BALANCED DETECTOR TO A & B OF T1
LOOSELY COUPLE VHF MARKER GEN. TO PIN 2 OF V1
J2 XTAL CURRENT
L5

Fig. 34—U70 R-F Alignment Connections and Adjustments

7. Connect the UHF sweep generator through a 6-db pad to the 72-ohm coaxial input to the selector at J1. It is necessary to use the pad so that impedances will be matched. Otherwise, standing waves on the sweep cable may become objectionable.

8. Connect the UHF marker generator loosely to the selector input.

9. Connect a VHF marker generator loosely to the cathode of V1. Insert an 82.5-mc. marker into the selector.

630-Mc. Adjustments—1. Turn the dial drive mechanism until the dial pointer points to the 630-mc. calibration mark scribed on the dial back plate at 17 degrees left of center.

2. Insert a 630-mc. marker from the UHF marker generator.

3. Set the UHF sweep generator to sweep from 615 mc. to 645 mc. and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to center the 630-mc. marker on the response curve.

4. The shields must be in place over the top and bottom of the R-F section when making any adjustments. Adjustment locations are shown in figures 35 and 36.

5. Adjust the C18 oscillator core until the markers for 630 mc. and 82.5 mc. coincide on the sweep pattern.

6. Adjust the cores of the R-F tuning capacitors C1 and C2 to obtain a maximum amplitude, symmetrical response curve centered about the 82.5-mc. marker.

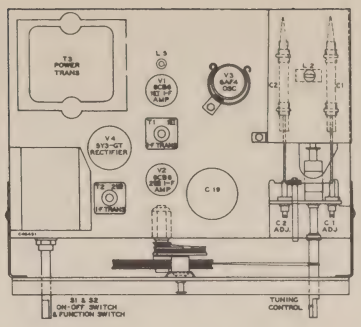


Fig. 35—U70 Top Chassis Adjustments

7. Set the bandwidth adjustment L2 until the response bandwidth is 20 mc. at 70% response.

8. Tune L5 for maximum response at the center of the bandpass.

9. Repeat the adjustments of C1, C2, L2 and L5 if necessary.

10. Plug the 0-5 ma. meter into the crystal current jack J2. The current should be between 0.8 ma. and 5 ma. If this current is not obtained, either the crystal is defective or the oscillator is not functioning properly.

IMPORTANT: The bottom cover should be in place when measuring crystal current.

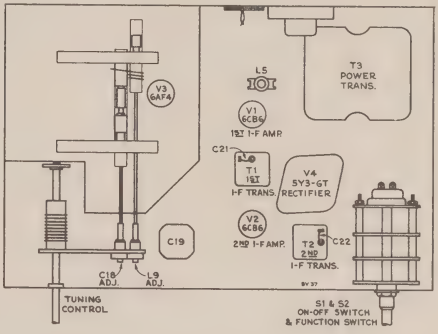


Fig. 36—U70 Bottom Chassis Adjustments

11. Turn off the sweep and marker generators. If the crystal current decreases by more than 10%, it indicates that excessive input signals are being employed. Proper alignment cannot be obtained under such conditions.

490-Mc. Adjustments—1. Set the UHF marker generator to 490 mc.

2. Set the UHF sweep generator to sweep 475 mc. to 505 mc.

3. Turn off the 82.5-mc. marker generator.

4. Turn the UHF selector toward the low frequency end of the band. Tune the selector and the sweep generator until the 490-mc. marker is centered in the bandpass.

5. Turn the 82.5-mc. marker back on.

6. Adjust C18 until the markers coincide. Then, overshoot the adjustment by an amount slightly less than the

amount of adjustment required to get the markers to coincide. Then close or spread the turns on the L9 coil until the markers again coincide.

7. Repeat the adjustments in the section above labeled "630-Mc. Adjustments." C1, C2, L2 and L5 probably will not require retouching. Then repeat the adjustments in the section labeled "490-Mc. Adjustments." Continue the repetition of the 630-mc. and 490-mc. adjustments until no further adjustments are required. Make the final adjustment at 630 mc. before proceeding with the next section.

840-Mc. Adjustments—1. Set the UHF marker generator to 840 mc. Turn off the 82.5-mc. marker generator.

2. Adjust the UHF sweep generator to sweep 825 mc. to 855 mc.

3. Turn the UHF selector dial drive and the sweep generator until the 840-mc. marker is centered in the bandpass of the response curve on the oscilloscope.

4. Turn the 82.5-mc. marker back on.

5. Adjust the L9 core until the two markers coincide.

Check of Tracking—1. Turn off the UHF marker generator.

2. Tune the sweep generator across the band in small steps. Tune in the sweep generator with the selector.

3. The response on the oscilloscope should not fall below 70% response between the 76.5-mc. and 88.5-mc. markers obtained from the VHF marker generator. The crystal current should be between 0.8 ma. and 5 ma. at all points between 470 mc. and 890 mc. when measured with the bottom shield in place and with no signal input.

Overall Response Check

1. Leave the sweep and signal generators connected as for R-F alignment.

2. Remove the 1,000-ohm resistor from terminals C and D of T1. Connect the 300-ohm balanced detector across the output terminal board TB3 and observe the overall response which should be similar to that shown in figure 32.

3. If excessive tilt appears, it may cause the picture to be overpeaked or smeared depending on the direction of the tilt. The maximum tilt or sag of the curve should not exceed 30%.

"On-the-Air" Check

As a final test, the selector should be tested on the air by receiving a known weak signal. If the picture obtained seems excessively snowy for a particular selector unit, it may be necessary to replace the mixer crystal CR1. If the crystal is changed, the R-F alignment should be retouched. A good crystal may perform no better than a defective one unless the R-F section is aligned for the good crystal.

Summary

The U70 Selector has continuous tuning over the entire UHF band which makes it a desirable unit for use in metropolitan areas where many UHF stations are in operation. Like the U2 Selector, the U70 has a self-contained power supply and is not dependent on the VHF television receiver for power. The signal-to-noise and gain characteristics of the U70 are very good and UHF reception is extended to remote areas.

No adjustments are required on the U70 Selector at the time of installation. Only power and antenna connections are required. The antenna connections, as described, should be adequate for all types of UHF and VHF inputs.

The U70 Selector has a more involved bench alignment procedure because of its continuous tuning feature. To obtain proper tracking across the UHF band, a balance of adjustments must be obtained between the R-F and oscillator circuits across the dial from 470 mc. to 890 mc. The two I-F stages, however, should be relatively easy to align.

KRK-12 TUNER

The KRK-12 UHF-VHF tuner is designed for twelve-channel VHF coverage and four-channel UHF coverage although any combination of the 16 VHF and UHF channels may be used. This coverage is made possible by tuned inserts which are placed within a drum assembly in the tuner. A 2-to-1 step-down ratio is used in the drive assembly to rotate the drum for ease of station selection. Figure 37 shows a comparison between the KRK-12 and KRK-11 Tuners.

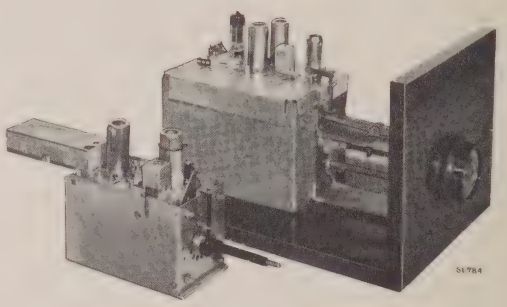


Fig. 37—KRK-12 Compared to KRK-11

VHF Operation

There are four different types of VHF inserts used in the KRK-12 which cover channels 2 through 4, 5 and 6, 7 through 10 and 11 through 13, respectively. Referring to the KRK-12 schematic diagram, figure 38, it will be seen that the four types of VHF inserts are similar in circuitry with the exception that capacitive coupling is used between the mixer and oscillator circuits on channels 2 through 6 and inductive coupling is used on channels 7 through 13.

Antenna Input

VHF signals are coupled through a balanced 300-ohm input to a tuned antenna transformer where channel preselection takes place. Two 43.5-mc. I-F traps, L1-C1 and L2-C2, are located in the antenna input circuit. FM rejection is effected with a 4⅜-inch length of 300-ohm line terminated with a 5-70 mmf trimmer capacitor at one end

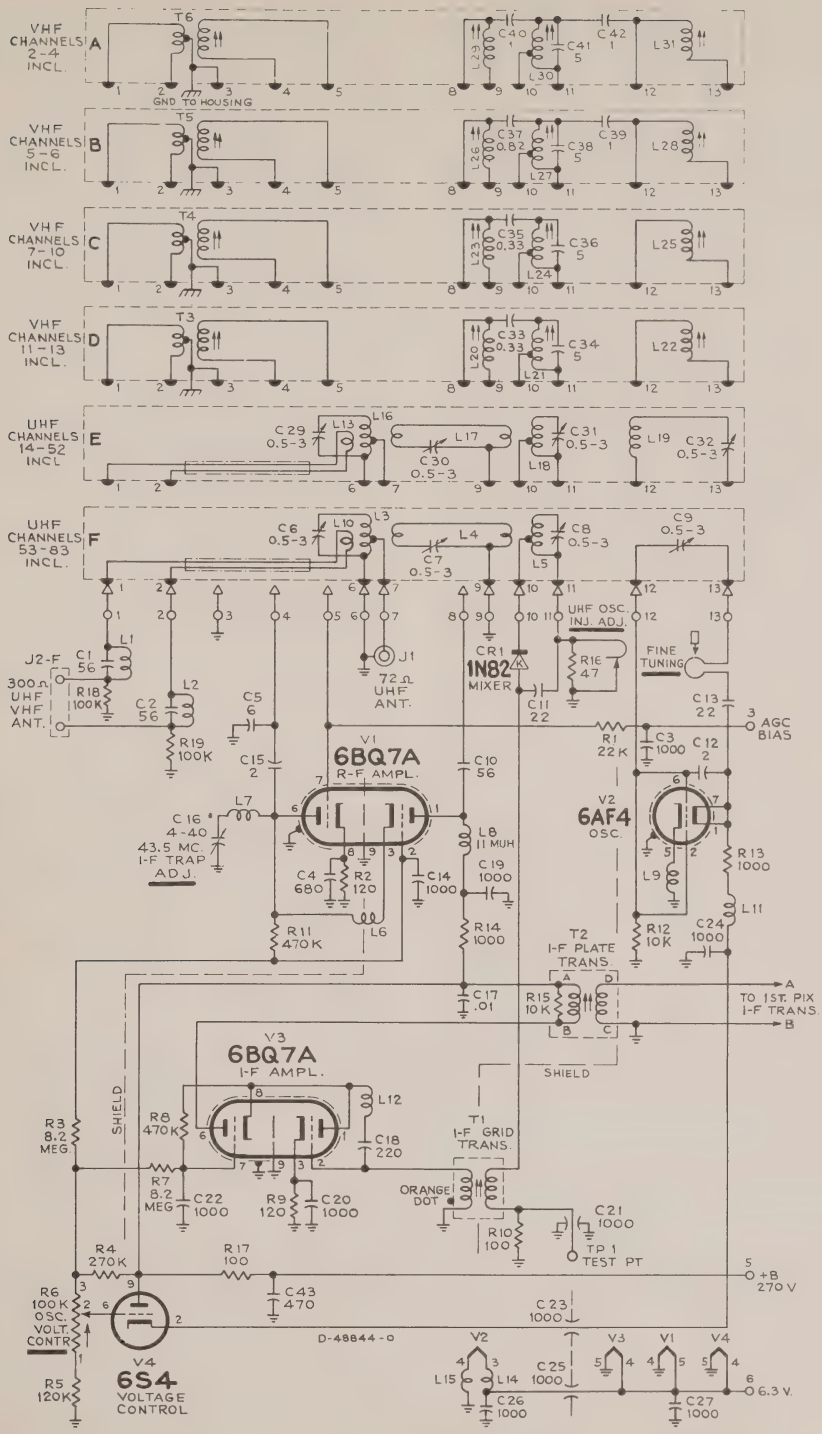


Fig. 38—Schematic Diagram—KRK-12 Tuner

and shorted at the other end. It is placed along the 300-ohm antenna input lead. The antenna transformer is mounted on the insert and its adjustment is accessible through the top of the tuner unit (as are the R-F plate, mixer and oscillator adjustments). See figure 39.

R-F Amplifier

The VHF signal is amplified by the R-F amplifier, V1, a type 6BQ7A connected in a driven grounded-grid amplifier circuit. An I-F trap (L7-C16) is located in this circuit for additional I-F interference rejection. Amplified VHF signals are developed across the plate circuit of the R-F amplifier which consists of a capacity-coupled, doubled-tuned circuit. The primary of this circuit is tuned with the output capacitance of the plate of the grounded-grid section of the R-F amplifier. (Symbol numbers are not used in this part of the description due to the variation of numbers entailed with the different inserts.) The secondary circuit consists of a variable inductance shunted by a 5-mmf. capacitor for all VHF channel inserts. Primary and secondary coils are tuned by threaded brass cores. The bandwidth of the coupled circuit is determined by the coupling capacitance and the crystal loading.

Mixer Stage

A type 1N82 silicon crystal diode is used in the mixer circuit. Here, the VHF signal is mixed with the local oscillator output to produce the I-F signal. The VHF oscillator voltage is injected into the mixer circuit capacitively on channels 2 through 6 and inductively on channels 7 through 13. The variable inductance in the mixer circuit is adjusted for the correct level of UHF oscillator injection voltage to the mixer. This adjustment has no appreciable effect on VHF operation. The oscillator injection level can be determined from a measurement of the voltage at the test point TP1, located on top of the tuner unit. The current should be between 0.3 and 3.0 ma. which will produce a voltage drop across R10 (100 ohms) of 0.03V. to 0.3V. This can be read on the 1.5V. scale of a vacuum tube voltmeter. The primary function of R10 is to provide self-bias on the crystal to improve the signal-to-noise ratio. TP1 can also be used for the observation of the overall R-F response by connecting an oscilloscope at this point.

Oscillator and Voltage Control Circuits

The oscillator stage uses a type 6AF4 tube in a modified Colpitts circuit. The oscillator tank is formed by C12, C13, the fine tuning control and tuned elements which are located on each insert. The fine tuning control consists of a brass core inserted into a low inductance one-turn coil in the shape of a slit cylinder. For VHF operation the fine tuning control is *effectively* a capacitive adjustment. (For UHF operation, it is inductive.)

Oscillator plate voltage is held to the limits of 85 to 115 volts by a voltage control tube, V4, a type 6S4 wired in series with the oscillator plate supply. A potentiometer, R6, part of a voltage divider network in the grid

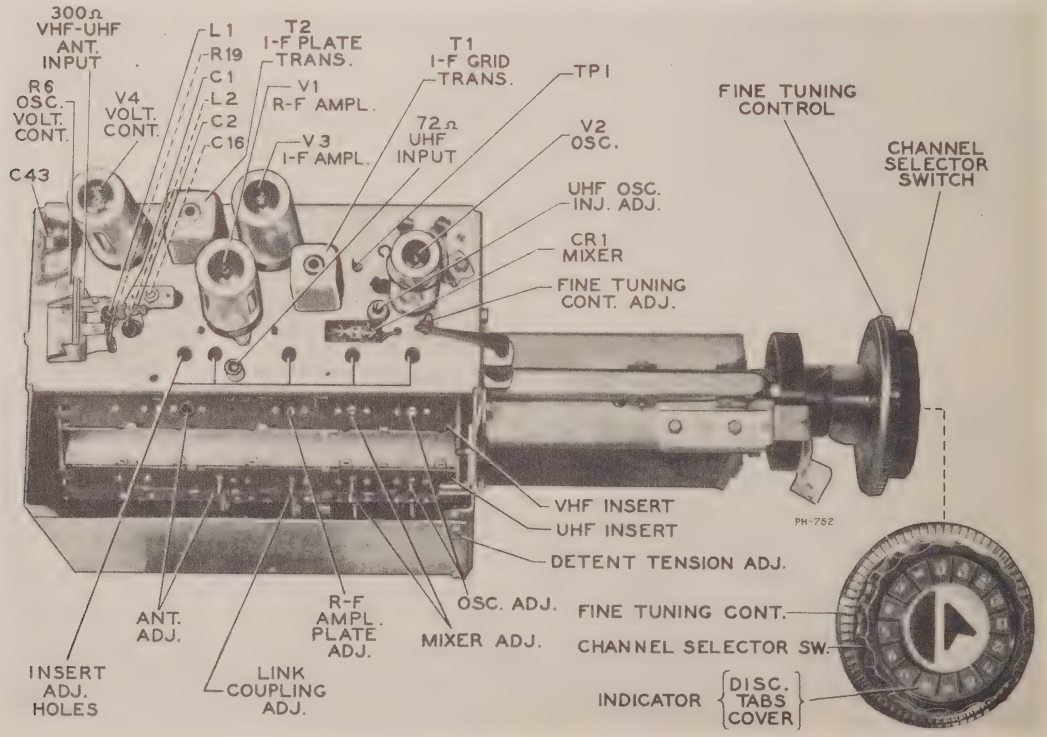


Fig. 39—KRK-12 UHF-VHF Tuner—Top Oblique View

circuit of V4, is used to adjust the level of conduction in this tube and thus set the plate voltage of the oscillator. When this adjustment is required, a 0-50 ma. meter is inserted in series with the cathode of V4 through an adapter socket and, with the oscillator in a non-oscillatory state, R6 is adjusted for a 28-ma. reading. A non-oscillatory state can be had by rotating the channel selector switch to a position between channels. (Some 6AF4 tubes may still continue to oscillate. To ensure a non-oscillatory state, the index finger can be placed across contacts 12 and 13 while the adjustment is being made. No DC potential exists on these contacts.) This adjustment may be required when a tube or other component is changed in the oscillator and voltage control circuit. Components located under the chassis are shown in figure 40.

I-F Amplifier

The I-F signal from the mixer is coupled through T1, a wide-band coupling transformer, to the I-F amplifier, V3. T1 is tightly coupled and provides an 8-mc. bandpass. The crystal R-F bypass C11 and the input capacity of V3 provide the required capacitance to tune T1 to 43.5 mc.

The I-F amplifier uses a type 6BQ7A tube in a driven grounded-grid amplifier circuit. Neutralization of the input triode section is effected by the shunt inductance L12 which resonates with the grid-to-plate capacity of V3 at the I-F frequency. The output of the amplifier is coupled through T2 to the I-F section of the receiver. T2 is the same type of I-F link coupling transformer used in the RCA KRK-11 R-F unit.

UHF Operation

For UHF operation, the KRK-12 uses essentially the same circuits as for VHF operation with one major exception. UHF signals are not coupled through the R-F amplifier stage, V1, but are fed through a triple-tuned preselector circuit to the mixer stage.

Preselector Circuit

The UHF preselector consists of a triple-tuned circuit using high "Q" tuning coils. The interstage coupling coil, L4 or L17, is shaped similar to a race track to obtain the required coupling between the input and output coils. By having the proper center-to-center distance between the input and output coils and by having the proper length for the coupling coil, the bandwidth of the preselector circuit can be made substantially constant across the UHF range.

When a common UHF-VHF 300-ohm antenna input is used for UHF reception, the signal is link-coupled into the input coil of the preselector circuit. Since the 300-ohm antenna coupling coil does not have a grounded center tap, two static drain resistors, R18 and R19, are used.

If a 72-ohm UHF input is used, a coaxial jack, J1, is provided which is coupled to a tap on the input coil. In this case, the 300-ohm link should be removed from the circuit on each UHF insert to isolate the UHF input coil from the 300-ohm VHF input.

CAUTION: Care should be taken when removing the link coil from the primary coil so that the latter is not damaged.

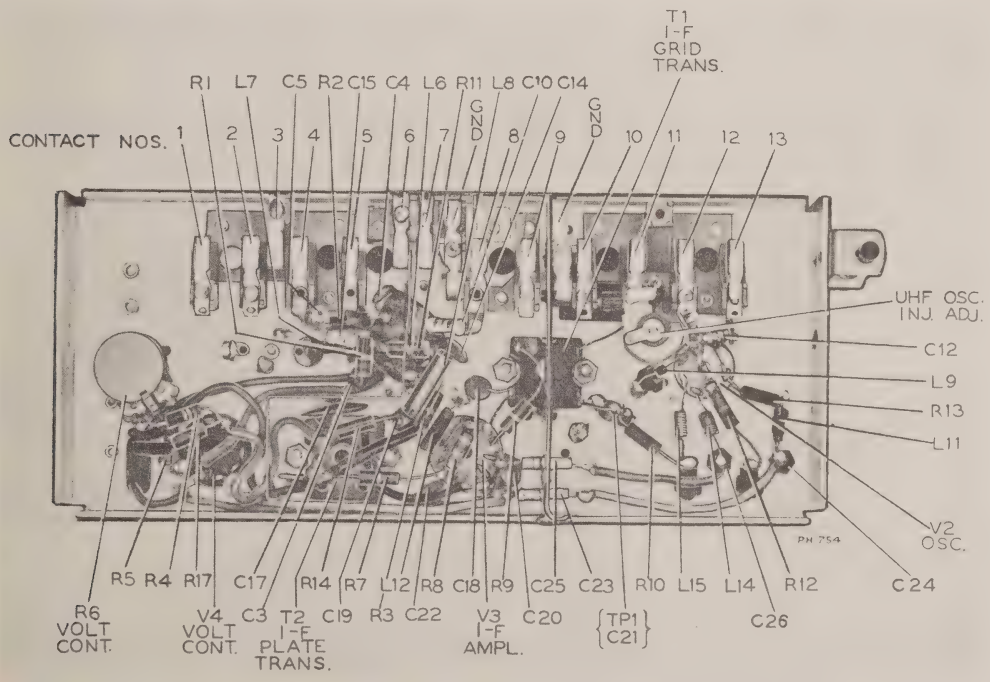


Fig. 40—KRK-12 Bottom Chassis View

Mixer Stage

The output coil and capacitor of the preselector circuit serve as a tank circuit for the mixer stage. The coil is tapped so that a proper match is effected to the input of the crystal mixer CR1. Unlike VHF operation, where oscillator signal was coupled directly into the mixer tank circuit, the oscillator signal for UHF operation is coupled into the mixer circuit between the ground side of the mixer tank circuit on the insert and the ground point on the tuner unit chassis. The coupling element is in the form of a variable inductance which is adjacent to the oscillator tank circuit. The variable inductance is adjusted to give a crystal current of between 0.3 ma and 3.0 ma. Measurement of the resulting voltage drop can be made across R10 as is done for VHF operation. See page 22.

Oscillator and Voltage Control Circuits

This circuit is quite similar to that used for VHF operation with the exception that 0.5 to 3.0 mmf. trimmer capacitors are used in the oscillator tank circuit. The capacitors are mounted on the insert (see figure 41) and can be adjusted through an opening in the top of the tuner chassis when the insert is connected in the circuit (see figure 39). The fine tuning for UHF operation is *effectively* a variable inductance in the grid-to-plate circuit of the oscillator. The plate-to-grid and plate blocking capacitors, C12 and C13, are used to compensate for oscillator frequency drift at the low end of the UHF range. At the high end, a short bimetallic strip is used near the oscillator trimmer capacitor for compensation of frequency drift caused by the circuit components and oscillator tube.

I-F Amplifier

The operation of the I-F circuits is similar for both UHF and VHF reception. Reference is made to the circuit description under VHF operation, page 23.

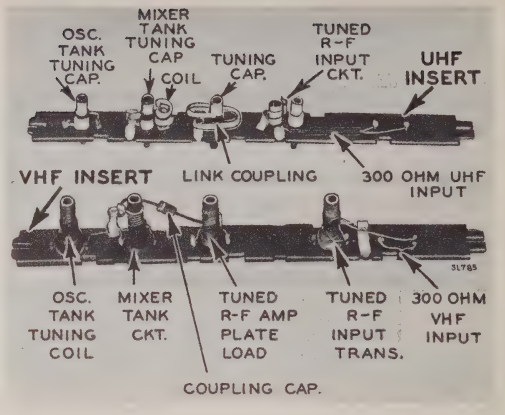


Fig. 41—UHF and VHF Inserts for KRK-12 Tuner

KRK-25 UHF-VHF TUNER KIT

Thus far the KRK-12 tuner has been discussed as a separate unit, apart from the main receiver chassis with which it is associated. A complete story would include the fact that the KRK-12 appears in a kit form in addition to its inclusion in RCA Victor television receivers. The kit form, designated as the KRK-25, includes the KRK-12 tuner plus all the necessary material needed to install this tuner in place of the existing VHF tuner on RCA Victor television receivers which use a 40-mc. I-F system. The KRK-25 is shown in figure 42.

Installation Instructions

The KRK-25 Tuner Kit may be installed in the following RCA Victor television receivers:

Model	*Name*	*Chassis No.*	*Model*	*Name*	*Chassis No.*
17T150	"Colby"	KCS66C	17T250DE	"Brett"	KCS74
17T151	"Glenside"	KCS66C	17T261DE	"Ainsworth"	KCS74
17T153	"Bristol"	KCS66	21T159	"Selfridge"	KCS68E
17T154	"Whitfield"	KCS66	21T159DE	"Selfridge"	KCS68F
17T155	"Preston"	KCS66	21T165	"Meredith"	KCS68E
17T160	"Hampton"	KCS66	21T166DE	"Farmington"	KCS68
17T162	"Caldwell"	KCS66A	21T174DE	"Bancroft"	KCS68F
17T163	"Crafton"	KCS66C	21T175DE	"Benton"	KCS68F
17T172	"Covington"	KCS66A	21T176	"Suffolk"	KCS68C
17T172K	"Covington"	KCS66D	21T177	"Donley"	KCS68C
17T173	"Calhoun"	KCS66A	21T178	"Rockingham"	KCS68C
17T173K	"Calhoun"	KCS66D	21T178DE	"Rockingham"	KCS68F
17T174	"Kendall"	KCS66A	21T179	"Clarendon"	KCS68C
17T174K	"Kendall"	KCS66D	21T179DE	"Clarendon"	KCS68F
			21T197DE	"Sunderland"	KCS68H

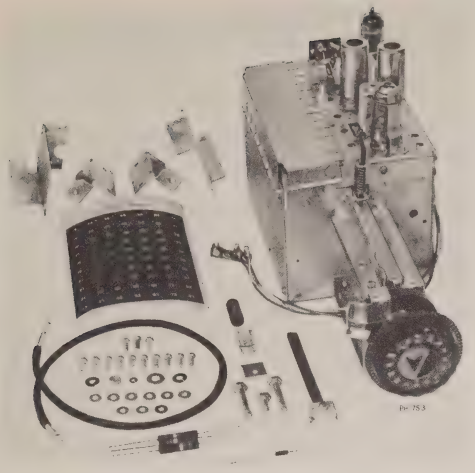


Fig. 42—KRK-25 Tuner Kit

NOTE: It is important to make sure that the receiver is in proper operating condition before proceeding with the installation of the tuner. Service Data should be at hand for the particular chassis on which the KRK-25 is being installed.

Cabinet Modifications

1. To make the required modifications on the cabinet, the receiver chassis must be removed from the cabinet.
2. Two ½-inch holes can then be drilled in the receiver chassis shelf. The two holes are located by using the template that is supplied with the instructions in the kit. The locations of the holes are shown in figure 43.

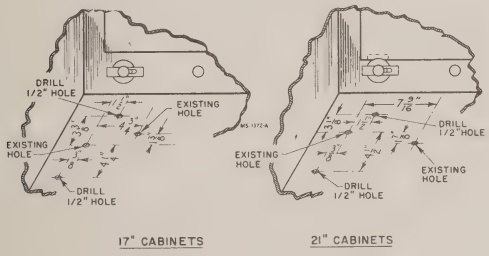


Fig. 43—Cabinet Shelf Modification

3. The next step is to modify the channel selector hole as shown in figure 44. For this operation the channel marker escutcheon must be removed from the cabinet.

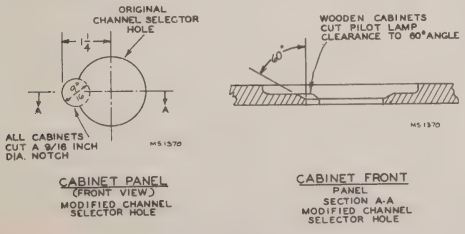

ORIGINAL CHANNEL SELECTOR HOLE
ALL CABINETS CUT A 9/16 INCH DIA. NOTCH
CABINET PANEL (FRONT VIEW) MODIFIED CHANNEL SELECTOR HOLE
WOODEN CABINETS CUT PILOT LAMP CLEARANCE TO 60° ANGLE
CABINET FRONT PANEL SECTION A-A MODIFIED CHANNEL SELECTOR HOLE

Fig. 44—Cabinet Panel Modification

In addition, on metal cabinets, the inside ring is removed and the ring tabs are bent flush against the cabinet. The channel selector hole is modified by cutting a semi-circular notch 9/16 inch in diameter. On wooden cabinets, the notch must also be undercut. Refer again to figure 44. The notch is cut for clearance of the channel indicator lamp.

4. To allow clearance for the indicator lamp bracket on 21-inch receivers, a portion of the plastic kine mask must be cut out. This cutout is shown in figure 45. Two

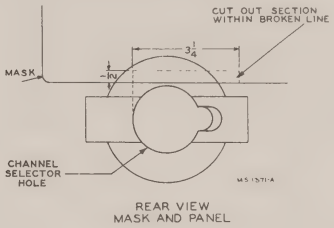


Fig. 45—Mask Modification on 21" Models

methods are recommended for making this cutout. (1) A series of small holes may be drilled along the cutting line and the piece broken out. (2) A special tip can be made for the commonly used types of soldering guns for use as a heat source to melt the mask along the prescribed cut-out line.

The specifications for the tip are illustrated in figure 46. The shape of the wire is not critical, but the diameter should be made as shown to get maximum heat into the tip.

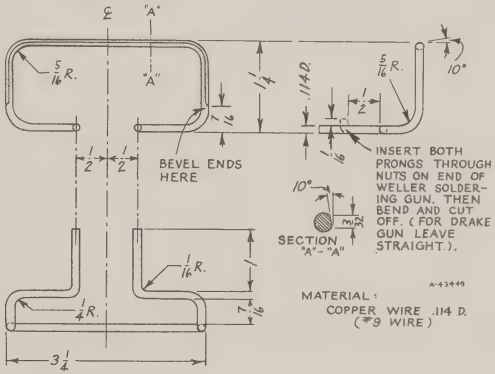

BEVEL ENDS HERE
INSERT BOTH PRONGS THROUGH NUTS ON END OF WELLER SOLDERING GUN, THEN BEND AND CUT OFF. (FOR DRAKE GUN LEAVE STRAIGHT).
SECTION "A"-"A"
MATERIAL: COPPER WIRE .114 D. (#9 WIRE)

Fig. 46—Soldering Gun Tip

Removal of Present Tuner

1. The cable clamp is removed from the side of the tuner so that the leads are free. Before any leads are removed, the color code of all leads should be written down for later reference.
2. Disconnect the shielded cable from ground and terminal "A" at T104 (1st Pix I-F Grid Transformer). (Refer to the Service Data booklet for the particular receiver being worked on.)

3. Disconnect the AGC lead at terminal 3 of the tuner.

4. On all 17-inch models except 17T250DE and 17T261DE, the B plus lead which feeds terminal 4 on the tuner through a 100-ohm resistor should be disconnected at the terminal board on the receiver chassis Connect the 18,000-ohm 2-watt resistor, that is supplied with the kit, between this point on the chassis terminal board and a nearby ground lance.

5. On Models 17T250DE and 17T261DE only, disconnect the B plus lead at C212B which goes to terminal 4 on the tuner. Connect the 18,000-ohm 2-watt resistor, supplied with the kit, from the junction of C212B and R188 on the terminal board, to the nearby ground lance.

6. On 21-inch models only, disconnect the B plus lead from the small two-terminal board on the rear of the tuner. This lead goes to the 100-ohm resistor on terminal 4 on the tuner. Pull the lead inside of the receiver chassis and run it to the unused pin 7 of V123. The 18,000-ohm 2-watt resistor, supplied with the kit, is connected between pin 7 of V123 and a nearby ground lance.

7. On all models, disconnect the 265-volt B plus lead at the two-terminal board on the rear of the tuner.

8. Disconnect the heater lead at terminal 6 of the tuner.

9. Disconnect the B plus lead at the receiver chassis terminal board which comes from terminal 7 on the tuner.

10. Remove the transmission line connector from the antenna input jack on the tuner.

11. Unclip the channel indicator lamp and discard the lamp cover.

12. Remove the tuner and its mounting bracket from the receiver chassis.

UHF-VHF Tuner Installation

1. Remove the KRK-25 Tuner Kit from the shipping carton. Make sure that all tubes are in place and firmly seated in their sockets.

2. Remove the speaker cable clamp from the receiver chassis.

3. Locate the mounting holes for the tuner by using the templates supplied with the kit. The two large brackets are used with 21-inch receivers. On receivers using Chassis No. KCS74, these holes are already provided.

4. An alternate method for locating the mounting holes may be used if desired. This is accomplished by locating the position of the top mounting hole of the front bracket, see figure 47. On 17-inch models this hole is located 4 1/4 inches from the chassis front and 5/16 inch in from the right side of the chassis. On 21-inch models the hole is located 2 5/8 inches from the chassis front and 5/16 inch in from the right side of the chassis. The remaining holes may be located by assembling the appropriate brackets on the tuner, placing the tuner in position with the top front hole as a guide, and spotting the other holes.

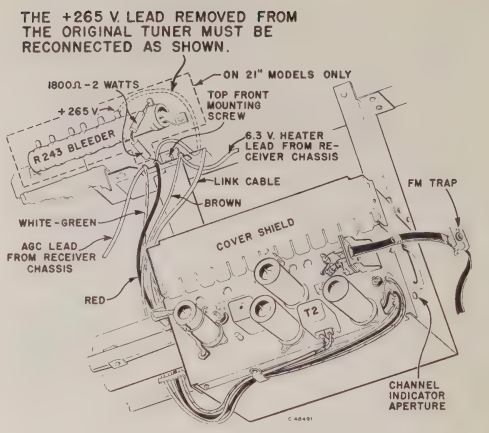


Fig. 47—Assembly of KRK-25

CAUTION: Check the position of components and cables under the chassis before drilling holes to avoid possible damage.

5. Drill all chassis holes using a #30 drill to fit the self-tapping screws provided.

6. On 21-inch models only, a chassis lance partially occupies the location of the hole for the top screw of the rear bracket. Bend the lance flush to the chassis. Drill the hole with a #8 drill and use the machine screw, washers and nut provided in the tuner kit for this mounting hole.

7. Mount the tuner on the receiver chassis. A flat surface should be used to support the tuner and receiver chassis to assure proper mechanical alignment.

8. Mount the three-lug terminal board, attached to the tuner leads, under the top front mounting bracket screw with the terminals facing the tuner as in figure 47.

9. Connect the link cable to T2 on the tuner as shown in figure 47, grounding the shield on the lance provided.

10. Connect the other end of the link cable to terminal "A" of T104 (1st Pix. I-F Grid Transformer), grounding the shield to the adjacent chassis lance. The link cable must be shunted with a 1000-ohm resistor and a 5-70 mmf. trimmer capacitor. Add these components, from the kit, at T104 if they are not part of the original circuit. Remove any existing fixed resistors and capacitors which shunt the link cable in some models.

11. Connect the AGC feed to the white-green lead from the tuner at the terminal board previously mounted on top front of the receiver chassis. See figure 47.

12. Connect the (265V) B plus feed to the red lead from the tuner at the terminal board.

13. Connect the heater feed to the brown lead from the tuner at the terminal board.

14. On 21-inch models only, connect the two 1800-ohm 2-watt resistors, supplied in kit, in series between the center lug of the terminal board holding the red lead from the tuner and the rear terminal (plus 373 V.) of R243 bleeder resistor mounted on the top right front corner of the receiver chassis. See figure 47.

15. Clip the channel indicator lamp on the tuner lamp bracket and install the lamp cover, supplied in kit, with the aperture facing the front.

Receiver Antenna Input Modification

1. The existing antenna input connector may be used when modified. Cut off the two closely-spaced jumpered pins close to the bakelite disc. Insert the connector in the tuner jack and fasten in position using the retainer plate and screw provided in the kit.

2. An FM trap is supplied with the kit. It consists of a 4⅜-inch length of flat 300-ohm transmission line with a 5-70 mmf. shunt trimmer at one end; the opposite end is shorted. Tape the trap securely to the receiver antenna cable at some convenient location between the receiver terminal board and the tuner as shown in figure 47. The exact position of the trap is not important except for convenience of trimmer adjustment.

3. When a common UHF-VHF antenna is used in fringe areas, to reduce noise pickup, the contact springs under the UHF coaxial input jack J1 must be bent upwards, to prevent contact with the buttons on the inserts. Remove the tuner cover. Rotate the channel selector knob until an empty drum compartment lies under the input jack J1. The two springs will now be accessible and may be bent upwards sufficiently to clear the insert buttons.

4. When coaxial cable is used for the UHF input, attach the ferrule supplied on the coaxial input jack J1, to the coaxial cable. The use of a separate UHF antenna, fed to the coaxial input jack J1, will require removal of the antenna coupling loop from all UHF inserts used. Cut the coupling loop wires at the contact buttons to which they are soldered. Remove the tape securing the loop to the insert. The loop is then removed by carefully rotating until it slips out easily.

5. Antenna connections to the KRK-12 Tuner are shown in figure 48 for four conditions of line inputs.

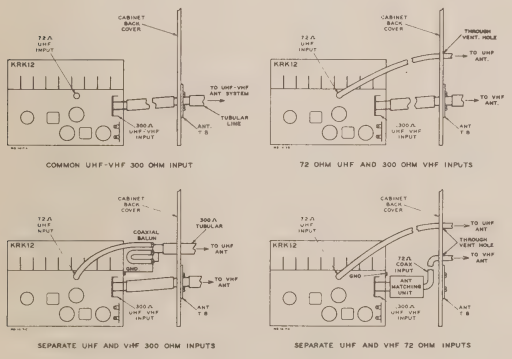

KRK12
COMMON UHF-VHF 300 OHM INPUT
72 OHM UHF AND 300 OHM VHF INPUTS
SEPARATE UHF AND VHF 300 OHM INPUTS
SEPARATE UHF AND VHF 72 OHM INPUTS

Fig. 48—Antenna Connections to KRK-12

Knob Assembly

1. The proper order of knob assembly is shown in figure 49.

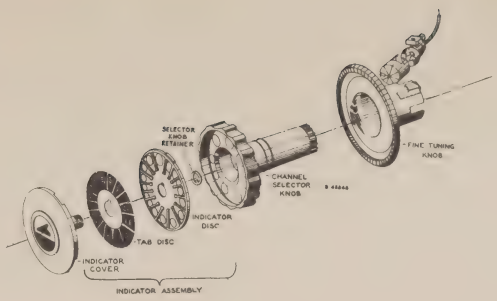


Fig. 49—Knob Assembly

2. Place the fine tuning knob on the shaft and rotate until one of the slots engages the projection on the fine tuning cam. Push the knob in until seated firmly against the cam.

3. Place the channel selector knob and the knob retainer on the shaft. Rotate the knob until the knob teeth mesh with the drive gear, at a point where a hole in the knob face is over the channel indicator lamp. Push the knob and retainer in until firmly seated.

4. Remove tabs from the tab disc corresponding to any UHF channels to be used. Mount the tab disc on the indicator disc. The proper position will be indicated by the keyway on the tab disc meshing with the key on the indicator disc. Remove the required UHF channel number tabs from the sheet supplied and mount on the indicator disc.

5. Assemble the indicator disc and cover by matching the projection on the disc to the smallest cover recess.

6. Mount the indicator assembly on the shaft, matching the flats on the assembly spring and the shaft. Push the assembly into position.

Insert Adjustments

1. Some factory prealigned UHF inserts may require minor adjustments when installed in the tuner. This can be accomplished by using the UHF station as a signal source.

NOTE: Caution should be taken to observe for reference the initial position of all cores before making any adjustments.

2. Set the fine tuning control to the center of its range on the channel to be adjusted. Adjust the oscillator core for this channel to obtain maximum audio output without distortion. Adjustment of the triple-tuned circuit, UHF antenna, UHF link coupling and mixer cores may be made, if necessary, to obtain best picture and sound.

Detent Tension Adjustment

The tension of the detent roller may be adjusted by the detent tension adjustment. See figure 39.

Removal and Installation of Inserts

Insert Removal

1. Remove the tuner cover shield. Rotate the channel selector to the desired channel. The channel insert position may be identified by the stampings on the insert drum which are visible through the channel indicator apertures at each end of the tuner. Figure 47 shows the rear aperture.

CAUTION: Before trying to remove an insert be sure that the spring clips have been removed which hold the inserts securely in the drum during shipment. There are eight spring clips located at the rear of the drum between adjacent pairs of inserts. The clips are removed by pressing the ends of the clip together until the clip clears the insert and can be lifted out of the tuner.

2. Rotate the channel selector two positions counterclockwise. Three inserts will be clearly visible in the tuner cover opening. The second insert below the contact springs is the one desired.
3. Remove the insert by the insert buttons, do not grip the adjusting screws. Slide the insert to the rear until the notches on the insert clear the drum tabs. Lift the insert upward and remove.

Insert Installation

1. Identify the proper insert chamber in the manner previously described.
2. The insert has two fingers at each end. Place the longer insert fingers in the notch at the rear of the drum and lower the insert into the drum chamber. Push the insert back against the retaining spring until the notches clear the tabs on the sides of the chamber. Carefully press the insert down until seated over its entire length. Release the tension applied against the retaining spring allowing the insert to move forward under the tabs. The short fingers on the insert will enter the slot in the front drum disc when the insert is properly seated.
3. Replace the tuner cover shield.

Alignment Procedure

Test Equipment

Alignment of the KRK-25 Tuner can be accomplished with the following test equipment:

1. VHF Sweep Generator meeting the following requirements:
   (a) Frequency Ranges
   35 to 90 mc. with 1 mc. to 12 mc. sweep width
   170 to 225 mc. with 12-mc. sweep width
   (b) Output adjustable with at least .1 volt maximum.
   (c) Output constant on all ranges.
   (d) "Flat" output on all attenuator positions.
2. VHF Signal Generator to provide the following frequencies with crystal accuracy:
   (a) Intermediate frequencies
   39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
   (b) Radio frequencies

Channel Number	*Picture Carrier Freq. Mc.*	*Sound Carrier Freq. Mc.*	*Receiver R-F Osc. Freq. Mc.*
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

   (c) Output of these ranges should be adjustable to .1 volt maximum.
3. VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.
4. UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.
5. UHF Signal Generator to provide the following frequencies with crystal accuracy:

Channel Number	*Picture Carrier Freq. Mc.*	*Sound Carrier Freq. Mc.*	*Receiver R-F Osc. Freq. Mc.*
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685

Channel Number	*Picture Carrier Freq. Mc.*	*Sound Carrier Freq. Mc.*	*Receiver R-F Osc. Freq. Mc.*
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

6. Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

7. Electronic Voltmeter.—A voltmeter with a 1.5-volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

8. DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

9. Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4. Wiring of adapter is shown in figure 50.

10. Two 7.5-volt adjustable bias supplies.—A 7.5-volt battery shunted by a 1000-ohm potentiometer is suitable.

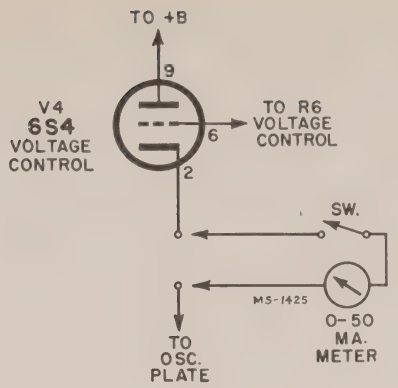


Fig. 50—Adapter for Voltage Control Adjustment

Alignment of VHF Circuits

1. Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert 6S4 in the adapter.
2. Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.
3. Remove the tuner cover shield.
4. Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front, with a finger.

NOTE: The contacts are at zero DC potential.

5. Should the plate current rise, keep finger on the contacts while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28-milliampere reading on the meter.
6. Replace the tuner cover shield.
7. Connect the VHF sweep generator to the antenna terminals.
8. Connect the VHF signal generator loosely to the antenna terminals.
9. Connect the oscilloscope (through the preamplifier if needed) to test point TP1.
10. Ground the AGC bias at the tuner terminal board (using a clip lead) to insure that the bias will remain constant.
11. Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of R-F/I-F interaction when a crystal is used as a mixer.
12. Set the channel selector and the sweep generator to channel 2.
13. Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.
14. Adjust antenna T6, R-F amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the

100% response points are shown in figure 51(a) and (c). If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

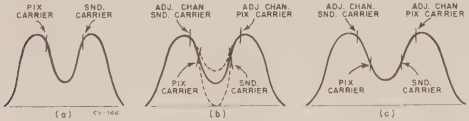


Fig. 51—KRK-12 VHF Insert Responses

NOTE ON KRK-12 TUNER ALIGNMENT.—The use of a crystal mixer makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable R-F/I-F interaction if the oscillator is allowed to operate during alignment. Therefore, the responses shown in figure 51 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in figure 51(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in figure 51(a) and 51(c).

15. Repeat the above steps for all VHF channels adjusting the appropriate antenna, R-F amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.
16. Turn off the sweep generator.
17. Remove the oscilloscope and preamplifier if used, from test point TP1.
18. Turn the AGC control fully clockwise.
19. Remove the clip lead grounding the AGC bias on the tuner terminal board.
20. Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.
21. Connect the potentiometer arm of the second bias supply in the receiver chassis to the junction of R143 and R144 (R193 and R194 on KCS74 chassis with 6CL6 for V110), and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of I-F bias as indicated on the "VoltOhmyst" at the junction point.
22. Connect the oscilloscope to pin 4 of V110 (pin 2 of V110 where 6CL6 is used).
23. Turn the adapter switch on to apply plate voltage to the oscillator.
24. Turn the channel selector to Channel 13.
25. Set the fine tuning control to the center of its range.
26. Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "RF IN" terminal of the signal generator.
27. Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.
28. Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.
29. Adjust the tunable I-F trap C16-L7. To do this connect the signal generator to the fixed I-F trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F trap C16-L7 for minimum indication on the oscilloscope.
30. Remove the signal generator and the oscilloscope.

NOTE: The alignment of the I-F plate transformer T2 is part of the receiver picture I-F alignment procedure. Because of the similarity to procedures given in previous Service Clinic and Service Data booklets, reference is made to these publications if picture I-F alignment is required.

Alignment of UHF Circuits

1. Turn off the adapter switch, removing the plate voltage from the oscillator.
2. Ground the AGC bias at the tuner terminal board (using a clip lead) to insure that the bias will remain constant.
3. Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.
4. Connect the UHF sweep generator to the antenna terminals. Use a 10db attenuator pad to assure proper alignment.
5. Connect the UHF signal generator loosely to the antenna terminals.
6. Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.
7. Insert markers of the picture carrier and sound carrier for desired channel.

8. Adjust UHF antenna link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

9. The responses are shown in figure 52. The curve shape will usually vary from figure 52(a) to figure 52(c) going higher in frequency. However, any of these responses are acceptable.

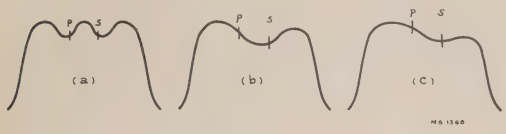


Fig. 52—UHF Insert Responses

10. Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

11. Remove the oscilloscope and preamplifier if used, from test point TP1.

12. Remove the clip lead grounding the AGC bias on the tuner terminal board.

13. Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

14. Connect the potentiometer arm of the second bias supply to the junction of R143 and R144 (R193 and R194 on KCS74 chassis with 6CL6 for V110), and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of I-F bias as indicated on the "VoltOhmyst" at the junction point.

15. Connect the oscilloscope to pin 4 of V110 (pin 2 of V110 where 6CL6 is used). Use 3 to 5 volts peak-to-peak output on the oscilloscope.

16. Turn the adapter switch on to apply plate voltage to the oscillator.

17. Turn the channel selector to the lowest UHF channel to be used.

18. Set the fine tuning control to the center of its range.

19. Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to the test point TP1 in series with a 100 mmf. capacitor and with the shortest leads possible. Insert a 45.75-mc. marker from the VHF generator.

20. Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75-mc. marker on the response curve as in figure 53.

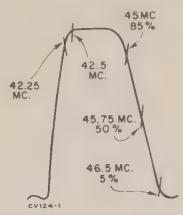


Fig. 53—Overall I-F Response

21. Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to TP1.

22. Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern.

23. Adjust mixer core for maximum gain with proper wave shape.

24. Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

25. Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

26. Repeat the above steps for all UHF inserts adjusting the ocillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

Summary

The KRK-12 is a new type of tuner designed to cover the VHF and UHF channel requirements of a given receiver location. A 16-position rotary tuner enables any combination of VHF and UHF channels to be selected. By using a 41-mc. I-F output, this tuner takes full advantage of the interference protection which the FCC provided in its channel allocation program.

In kit form, the KRK-12 can be used to convert 41-mc. RCA Victor receivers to UHF-VHF operation. If the instructions, as outlined in this booklet and included in the kit, are followed carefully, good results should be obtained.

All of the adjustments of the KRK-12 are accessible from the top of the tuner chassis. As a result, some adjustments can be made with the receiver chassis in the cabinet. This is particularly helpful when only touch-up adjustments are required in the R-F, mixer, oscillator or voltage control circuits. Touch-up adjustments may be required after tube replacement. However, a complete alignment procedure can be performed more easily with the chassis removed from the cabinet.

KRK-29A/27 TUNER

The KRK-29A/27 Tuner, figures 54 and 55, is a combination of a KRK-29A switch-type VHF tuner and a KRK-27 continuously-variable UHF tuner. The combination provides for 12-channel VHF coverage and all-channel UHF coverage. The KRK-29A is electrically similar to the KRK-11B and KRK-22 VHF Tuners with one major exception. In the KRK-29A, a thirteenth position (marked UHF) is used on the channel selector switch to change from VHF operation in the KRK-29A to UHF operation in the KRK-29A/27 combination. When switched to UHF operation, the combination uses the KRK-29A as an amplifier of the I-F output from the KRK-27.

UHF-VHF Changeover Function

The UHF position of the channel selector switch is marked on the right side of the escutcheon at the "three o'clock" position. The UHF marking is between the channel 2 and the channel 13 markings on the escutcheon and is the thirteenth position of the selector switch. In the UHF position, the fine tuning control is disengaged from the KRK-29A and is engaged to drive the tuning capacitors in the KRK-27. A dial scale, for UHF channel indication, is also driven by the tuning control. UHF channel numbers on the scale appear in a lighted window at the top (twelve o'clock) position on the escutcheon.

The clutch action on the tuning control is such that no detuning of the control is encountered when switching between VHF and UHF operation. Therefore, when the channel selector switch is turned from any VHF channel to UHF and the tuning control is rotated to any UHF channel, if the selector switch is returned to the same VHF channel, readjustment of the fine tuning control will not usually be necessary.

With the channel selector switch in any one of the twelve VHF channel positions, the KRK-29A functions as a VHF tuner similar to the KRK-22 or KRK-11B. When the channel selector switch is turned to the UHF position, the following operations are performed:

1. The VHF oscillator in the KRK-29A is disabled and the UHF oscillator in the KRK-27 is activated. A switch is actuated which removes plate voltage from the KRK-29A oscillator tube and applies the correct plate voltage to the KRK-27 oscillator tube. A cam assembly at the rear of the KRK-29A actuates this switch when the channel control is turned from VHF to UHF operation.

2. The VHF antenna input is switched from the KRK-29A and the UHF antenna input is applied to the KRK-27, in cases where a common UHF-VHF transmission line is used. Where separate transmission lines are employed,

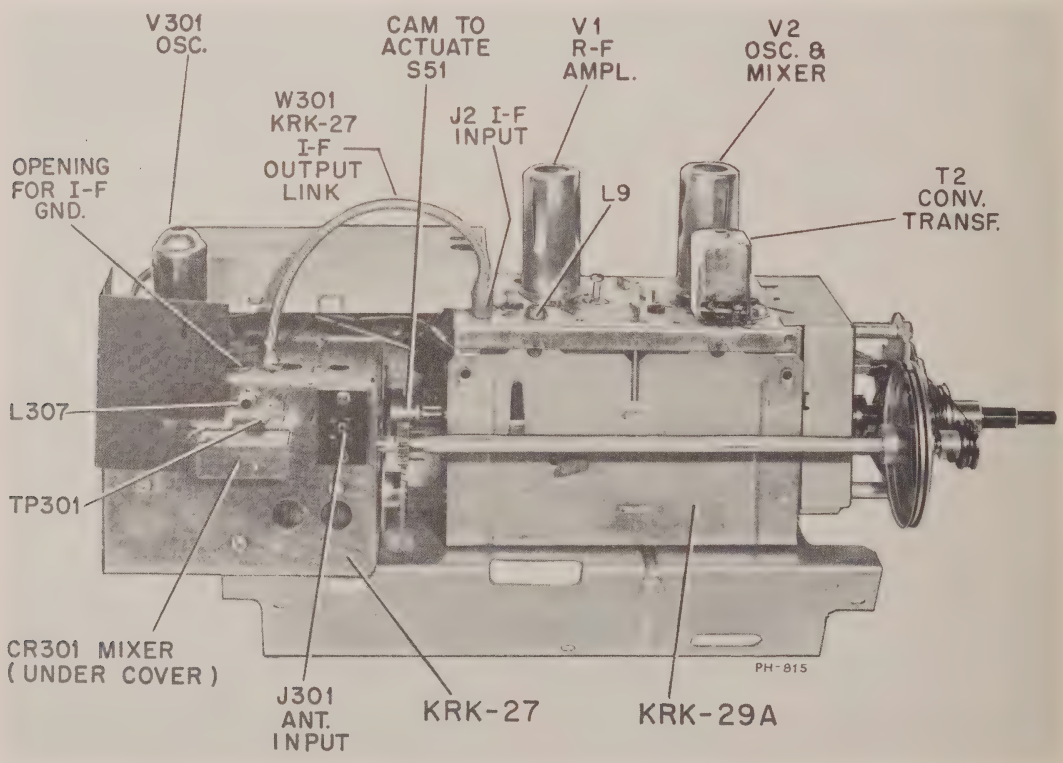


Fig. 54—KRK-29A/27 Tuner—Left Side View

the VHF antenna is switched from the KRK-29A and the UHF antenna input is connected to the KRK-27 at all times. The antenna input switching is performed by another set of contacts on the same switch that is used for switching the oscillator plate voltage.

3. The I-F signal output of the KRK-27 is switched to the input of the R-F amplifier, on the KRK-29A, which is used in UHF operation as a two-stage I-F amplifier. Switching for this operation is effected through the thirteenth position on the channel selector switch. In this position, the control grid of the R-F amplifier is transferred from the R-F output of the grid tuned circuit to the I-F output from the KRK-27. In addition, component switching is used to detune the 41-mc I-F trap in the amplifier circuit.

4. The amplified I-F signal is coupled to the mixer stage, on the KRK-29A, which is used in UHF operation as a third stage of I-F amplification. The R-F tuned circuits at the input to the mixer are by-passed by using switch contacts on the thirteenth position of the channel switch.

5. The fine tuning control for VHF operation is changed, by means of a clutch mechanism, to a continuous-tuning control for UHF operation.

Further details about the above operations are given in the following description on UHF circuit operation.

UHF Operation

For UHF operation, turning the channel selector switch to the UHF position activates the antenna input circuit, preselector, mixer, and local oscillator in the KRK-27 tuner unit.

The output from the UHF mixer is coupled into the KRK-29A tuner which becomes a three-stage I-F amplifier operating at 41 mc. (see figure 56). The 6BQ7A tube, a dual triode, which functions as the R-F amplifier in the VHF range, becomes the first and second I-F amplifier stages. The pentode section of the 6X8 VHF mixer-oscillator is used as the third stage of I-F amplification and has its output coupled to the receiver chassis I-F stages through the converter transformer T2. The VHF oscillator, which is the triode section of the 6X8, is inactivated when the channel selector switch is in the UHF position.

Input Circuit and Preselector

The UHF input impedance is designed to match a 300-ohm transmission line.

When a common UHF-VHF transmission line is used, the transmission line from the terminals marked "UHF" on the receiver antenna terminal board is connected to a switch S51, shown in figure 55. The switch is mounted at the rear of the KRK-29A tuner unit, adjacent to the

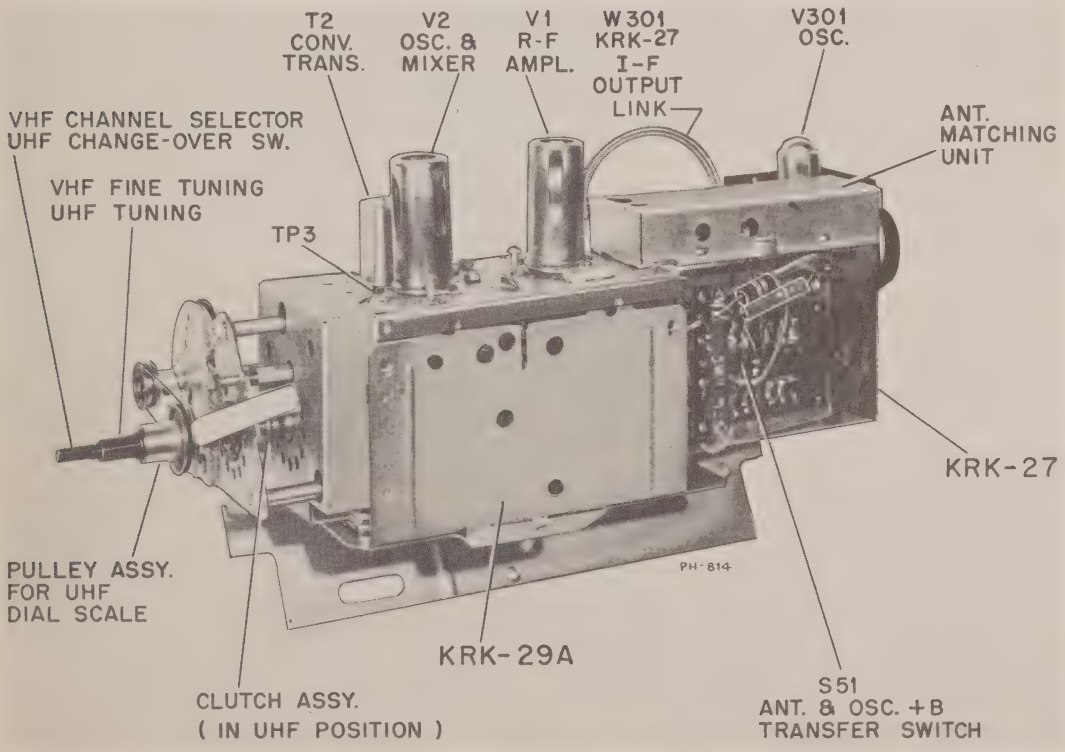


Fig. 55—KRK-29A/27 Tuner—Right Side, Oblique View

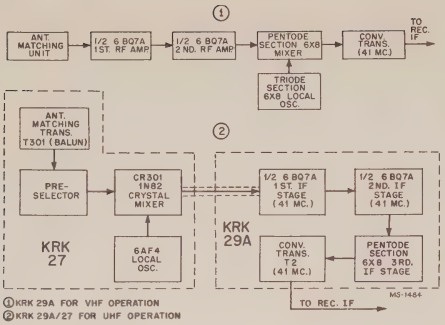


Fig. 56—Block Diagrams—KRK-29A/27 Tuner UHF and VHF Operation

KRK-27 unit. It changes from the transmission line going to the VHF input circuit, to the UHF transmission line going to the UHF input circuit, in conjunction with the channel selector switch. When the channel selector switch is in the UHF position, the UHF transmission line is connected through J301 to the antenna matching transformer T301. See figure 57.

NOTE: Where a separate UHF antenna system is used in addition to the VHF system, the UHF transmission line is connected directly to J301 and the UHF antenna is in the UHF input circuit at all times. In this instance, the antenna switching portion of S51 is used only to disconnect the VHF input circuit from the VHF transmission line.

T301 is a broad-band UHF balun constructed from 150-ohm twin-lead transmission line. The balun matches the 300-ohm impedance of the transmission line to 72 ohms impedance at the tap on the primary of the input inductance L301. C314, connected from one side of the balun to ground, compensates for physical shortness of the balun.

The frequency range of the preselector is set with adjustment screws the inductive effects of which are in series with the inductances L301 and L302. Turning the screws *in* (clockwise) increases the inductance and lowers the frequency. As the screws are turned *out* (counterclockwise) the inductance is decreased and the frequency is raised.

Channel selection is accomplished by C301A and C301B, the first two sections of the main gang-tuning capacitor. Tracking adjustments are made with the trimmer capacitors C315 and C316.

Mixer Stage

The output of the preselector is fed to the mixer CR301, a type 1N82 crystal diode, from a tap at the 500-ohm impedance point of the preselector output inductance L302. The inductance is tapped at 500 ohms impedance to match the crystal impedance at the I-F frequency.

In the mixer stage, the selected UHF frequency beats with the UHF oscillator to produce a difference frequency falling in the 41-mc. range of the I-F amplifier.

Oscillator Circuit

The UHF local oscillator uses a type 6AF4 triode in a modified Colpitts circuit to generate the necessary frequencies from 517 mc. to 931 mc. The oscillator operates at fundamental frequency throughout the UHF television band with 85 to 100 volts applied to the plate. Plate voltage is obtained through switch S51. When the channel selector switch is turned to the UHF position, the VHF oscillator plate voltage is disconnected from the VHF oscillator and the UHF oscillator plate voltage is increased to its normal operating value. This prevents interaction between the two oscillators. Oscillator plate voltage regulation is achieved through the resistor network R52, R53, R54, and the plate load resistor R303.

The oscillator tank circuit is tuned by C301C and C301D, the two large sections of the four-gang main tuning capacitor. C307 and C308 are the trimmer capacitors. C313, a 0.75 mmfd. negative temperature coefficient capacitor, and a bimetallic strip, which thermostatically changes the value of C307 with variations in chassis temperature, compensate for frequency drift.

Grid bias is developed across R304 and R305. A tap at the junction of R304 and R305 provides approximately —1 volt of bias for the 6X8 I-F amplifier grid.

The injection voltage to the mixer is limited by C305 at the low end of the UHF band, and by L303 at the high end, while R301 serves to equalize the injection voltage over the entire UHF band.

I-F Amplifier

During UHF operation, in addition to the I-F stages in the receiver chassis proper, three stages of I-F amplification are used in the KRK-29A/27 tuner unit. The VHF tuner, KRK-29A, is converted to a three-stage I-F amplifier operating in the 41-mc. output frequency range of the mixer stage. This function is accomplished when the channel selector switch is turned to the UHF position.

The first stage of I-F amplification (one half of the dual-triode 6BQ7A in the KRK-29A unit) is fed from the mixer stage through a low-pass inductance-capacitance network with L307 as the tunable primary inductance. L307 and its associated network are contained within the KRK-27 unit and couple to the secondary inductance L9, which is in the KRK-29A unit, through a shielded link cable W301.

The second I-F stage (the other half of the 6BQ7A) operates as a driven grounded-grid amplifier and is inductively coupled to the pentode section of the 6X8 which operates as the third I-F amplifier stage.

The output of the 6X8 is fed through the converter transformer T2 to the I-F stages in the receiver chassis.

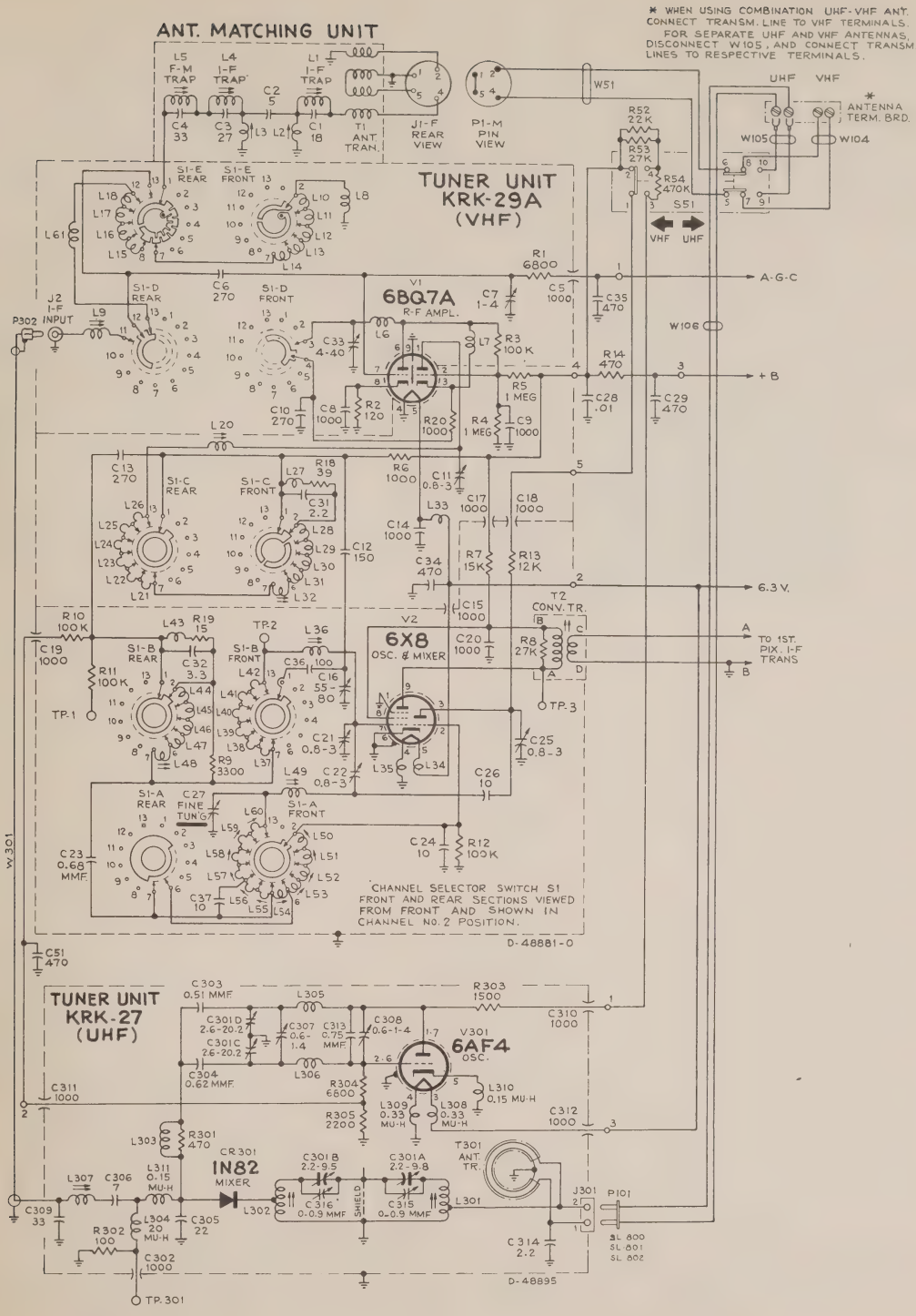


Fig. 57—Schematic Diagram KRK-29A/27 Tuner

Alignment Procedure

A complete alignment procedure for the KRK-29A/27 Tuner includes VHF alignment of the KRK-29A and UHF alignment of the KRK-27. Since the VHF alignment procedure of the KRK-29A is quite similar to that of the KRK-22 and KRK-11, and has been covered in previous Service Clinic and Service Data booklets, this procedure will not be included here. The UHF alignment of the KRK-27 will be covered in detail. To facilitate locating adjustments, component positions in the KRK-27 are shown in figure 58.

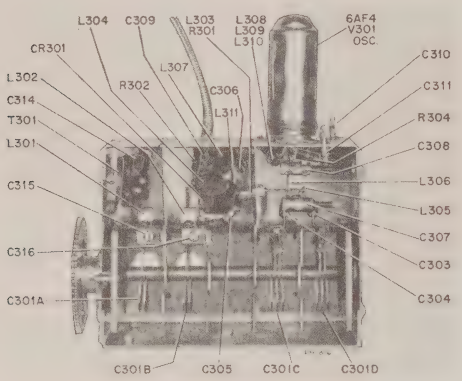


Fig. 58—Right Side View of KRK-27 Tuner

Test Equipment

Alignment of the KRK-27 can be accomplished through the use of the following test equipment:

A UHF sweep generator with a range of 470 mc. to 890 mc.
RCA type WR-40A or its equivalent.

A UHF marker generator for locating 473.5-mc. and 887.5-mc. markers.

A VHF sweep generator with an I-F output of 0—50 mc. frequency range and 0—10 mc. sweep width. Output should be adjustable to 0.1 volt maximum.

A VHF signal generator for locating 41.25-mc., 43.5-mc. and 45.75-mc. markers.

A cathode ray oscilloscope with a sensitivity of 1 millivolt per inch. A suitable preamplifier may be used with oscilloscopes of lesser sensitivity.

Electronic voltmeter (VTVM) with a 1.5-volt DC scale. RCA type WV-97A or equivalent.
Two 7.5-volt adjustable bias supplies.

R-F Alignment

1. For fast and accurate alignment of the tuning dial, a calibration dial is made to fit over the split gear on the front of the tuner. Scribe marks should be made at 0, 9 and 168 degrees on the calibration dial using a small protractor as a guide. The zero degree mark is the reference point with the capacitor plates fully meshed. The fully-meshed position can be located quickly and accurately by placing a $\frac{1}{16}$" shim between the stop plate on the gear assembly and the stop pin on the tuner.

2. Ground the I-F transformer by inserting a clip lead through the opening provided in the top of the tuner directly behind the I-F link cable (see figure 54). The other end of the clip lead is grounded to the tuner case.

3. Connect the oscilloscope to test point TP301 on the left side of the tuner. Use a preamplifier if it is required with the oscilloscope used.

4. Connect the UHF sweep generator, through a 300-ohm attenuator pad, to the KRK-27 antenna terminals. Adjust the sweep generator to sweep channel 83, centered at 887.5 mc., with full sweep width.

5. Connect the VHF signal generator in series with a 1000-ohm resistor to the rear terminal of the crystal holder. Insert marker signals for 41.25 mc., 43.5 mc. and 45.75 mc.

6. Connect the UHF marker generator loosely to the antenna terminals. Insert a marker signal for 887.5 mc.

7. Rotate the tuning dial to the 168 degree, channel 83, position.

8. Adjust trimmer capacitors C315 and C316 for a maximum amplitude, over-coupled response curve centered at 887.5 mc., as shown in figure 59A.

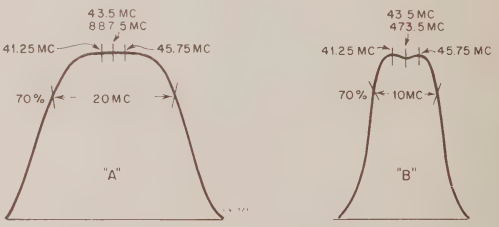


Fig. 59—KRK-27 R-F Response Curves

9. Adjust the oscillator trimmer capacitor C307 until the 43.5-mc. marker coincides with the 887.5-mc. marker. The 41.25-mc. and 45.75-mc. markers should be symmetrically located on the top of the response curve as shown in figure 59A.

10. Set the UHF sweep and marker generators to 473.5 mc.

11. Rotate the tuning dial to the 9 degree, channel 14, position.

12. Adjust L301 and L302 for a maximum amplitude, overcoupled curve centered at 473.5 mc, as shown in figure 59B.

13. Adjust the oscillator trimmer C308 until the 43.5-mc. marker coincides with the 473.5-mc. marker, with the 41.25-mc. and 45.75-mc markers as shown in figure 59B.

14. Repeat the above adjustments until the proper response is obtained at each end of the dial. Tune through the entire range of the dial and check the tracking.

Perfect tracking is achieved when the three markers are on top of the response curve. However, alignment will not be seriously affected if the 41.25-mc. and 45.75-mc. markers are as low as 70% on the response curve. Should the markers fall below 70%, it will be necessary to knife the plates of the R-F tuning capacitor with a knifing tool. In lieu of a standard knifing tool, a thin-bladed screwdriver may be used for the purpose of varying the separation between the stator and rotor plates. The plates may be knifed through the two holes provided on the left side of the tuner just below the antenna input jack. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Determine which capacitor section requires knifing by touching the plates with the knifing tool while observing the response. Proceed with the knifing of the proper section, or of both sections if required.

15. Connect a vacuum tube voltmeter to test point TP301. On the 1.5-volt DC scale, observe the reading while tuning over the entire range. A reading of between 0.05 and 0.4 volts should be obtained. Voltage readings outside of these limits are an indication of low +B voltage, low crystal impedance or an oscillator tube outside allowable limits.

I-F Alignment

1. Connect the I-F output of the VHF sweep generator to the rear terminal of the crystal holder in series with a 1000-ohm resistor and a 1500-mmf. capacitor.

2. Loosely couple the VHF signal generator to the rear terminal of the crystal holder. Insert marker signals for 41.25 mc. and 45.75 mc.

3. Set the channel selector to the UHF position and the tuning control to the middle of the UHF band. (670 mc.).

4. Connect a 180-ohm diode load detector (see figure 60), in series with a 1500-mmf capacitor (to avoid shorting out plate voltage) to test point TP3 on the top, front section of the KRK-29A tuner. Connect the output of the diode detector to the oscilloscope.

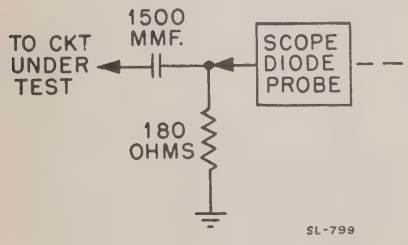


Fig. 60—180-ohm Diode Detector

5. Apply —5.0 volts to the I-F bias bus in the receiver (R147 in KCS-78H chassis, R148 in KCS-83D chassis).

6. Apply —3.0 volts to the R-F AGC terminal on the rear of the KRK-29A tuner.

7. Adjust sweep generator to produce 0.3 volt peak-to-peak or less on the oscilloscope.

8. Tune L307 (in KRK-27) and L9 (in KRK-29A) for maximum gain with picture and sound carrier markers as shown in figure 61.

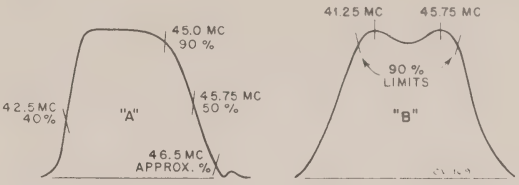


Fig. 61—KRK-29A/27 I-F Response Curves

9. Remove the diode detector from TP3 and connect it to the second detector load resistor (R138 in KCS-78H chassis, R135 in KCS-83D chassis).

10. Adjust sweep generator for 3 volts peak-to-peak on oscilloscope.

11. Retouch L307 and L9 slightly, if necessary, to produce curve as shown in figure 61.

12. Remove I-F sweep from mixer circuit and connect VHF sweep to KRK-29A antenna terminals.

13. Switch through all VHF channels and check for curve shape and marker positions as shown in figure 61.

14. Remove the VHF sweep and connect the UHF sweep to KRK-27 antenna terminals.

15. Switch to UHF operation and tune through all UHF channels. Check for curve shape and marker positions as shown in figure 59.

16. Retouch the third and fourth picture I-F transformers (T107 and T108 in KCS-78H and KCS-83D chassis), if necessary, to correct for any overall tilt or other condition that is essentially the same on all channels, VHF and UHF.

Summary

The KRK-29A/27 UHF-VHF Tuner provides for reception of the 12 VHF channels and the 70 UHF channels allocated at present. VHF channel selection is accomplished by conventional contact switching. UHF channel selection employs continuous tuning from channel 14 through channel 83.

A thirteenth position on the channel selector switch is used to change from VHF to UHF reception.

The continuous tuning feature in UHF operation of the tuner eliminates the need for internal adjustment of the tuner, or the receiver, for reception of new UHF channels which commence operation after the receiver has been installed, assuming the receiver is in proper alignment at the time of installation.

Direct conversion of the UHF signal to 41 mc., at the UHF mixer, takes full advantage of the interference rejection capabilities of the 41 mc. I-F system and, further, prevents possible interference and interaction from double conversion.

UHF ANTENNA INFORMATION

General

The question of which antenna is suitable for a particular installation is of major concern to every serviceman. Factors to consider are the simplicity of construction (cost), the ease of installation and the resulting picture quality. Everything will reflect, however, in the resulting picture quality.

With these factors in mind, a standard approach may be taken toward each new UHF installation. Either the built-in or the indoor type of antenna may work well in strong UHF signal areas. Since most television receivers have built-in antennas, the first step will be to try that antenna for UHF reception, observing the requirements of properly matching it to the UHF antenna input. If the use of the built-in antenna results in unsatisfactory reception, the next step will be to try an indoor type of antenna.

If the preceding methods result in a picture of poor quality, it will be necessary to resort to an outdoor antenna for UHF reception. In the case where VHF is being received, it may be possible to use the existing VHF antenna for UHF reception. Here, the transmission line can be connected to the selector and/or the receiver through the use of a balun, where necessary. It is recommended, however, that if flat 300-ohm line is being used, this line should be changed to a more practical type (tubular) for UHF signal transmission. The flat line may be satisfactory while it is dry but it will cause serious UHF signal attenuation when it is wet. A tubular twin lead or a twinex line would be better under wet conditions.

Another alternative for an outdoor UHF antenna is to mount a UHF antenna on the VHF antenna mast, if one exists. In this case, either a separate UHF transmission line or a common VHF-UHF line may be used. If a common lead-in is used, a cross-over network (see figures 79 and 80) must be used to match the outputs of the two antennas to the common lead-in. This network may be installed on the same mast with the antennas for the convenience of making connections.

The reception of UHF signals is rather critical with respect to antenna location and orientation. The VHF antenna mast (with a UHF antenna mounted on it) may be in a poor location for UHF reception. It will then be necessary to either relocate the VHF-UHF antenna mast for better UHF reception (without a sacrifice to VHF reception) or use a separate mast for the UHF installation. If a separate mast is used, it is advisable to use a separate transmission line which will keep losses at a minimum. However, even though a separate mast is used, it still may be practical to use a cross-over network somewhere along the UHF line run and have a common UHF-VHF line from there to the receiver.

Types of Antennas

Four basic antennas are most highly recommended for use in the UHF spectrum. Although several types of antennas have been designed, those described herein are considered most practical. There should always be a definite reason for considering one particular antenna.

Strong emphasis is placed on the "survey" system of determining the proper antenna to be used for each installation. This might seem to be an expensive way to make an installation but if the job is right at the time of initial installation, the costly "call backs" are eliminated.

The types of UHF antennas described herein are the Corner Reflector, Stacked "V," Triangular Dipole (Bow Tie) and Yagi.

Corner Reflector

The Corner Reflector antenna as shown in figure 62 is designed for high gain and sharp directivity throughout the UHF band. For locations where the signal is weak or reflections are a problem, this is the antenna recommended. Illustrations of gain and directivity characteristics are shown in figures 63 and 64.

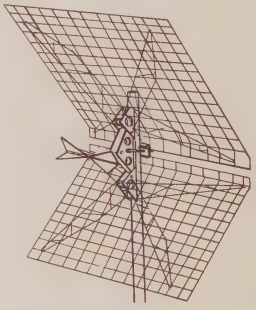


Fig. 62—Corner Reflector

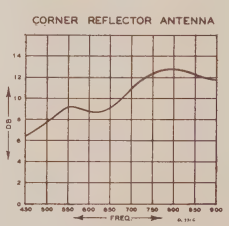


Fig. 63—Gain Curve—Corner Reflector

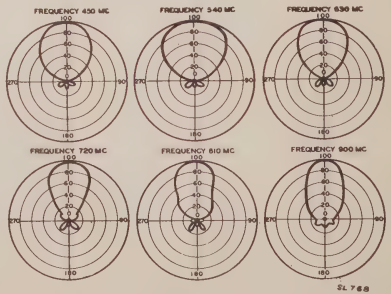


Fig. 64—Horizontal Field Patterns—Corner Reflector

Stacked "V"

The Stacked "V" antenna (see figure 65) is designed for reception of VHF and UHF television channels (2-83). This antenna is not critical with respect to direction on channels 2 through 6, and it is fairly bidirectional on channels 7 through 13. On channels 14 to 83, the Stacked "V" is unidirectional, however, a major back lobe exists on the higher channels. This antenna is recommended for use in the medium to strong signal areas where reflections are not a problem. Since it works well on both VHF and UHF, the use of this antenna may become very widespread. Illustrations of UHF-VHF characteristics are shown in figures 65, 66 and 67.

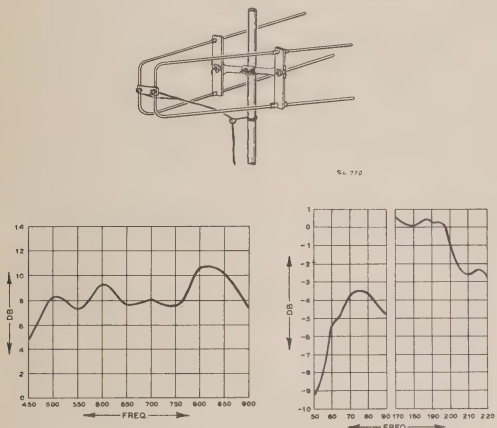


Fig. 65—Stacked "V" Antenna with UHF-VHF Gain Curves

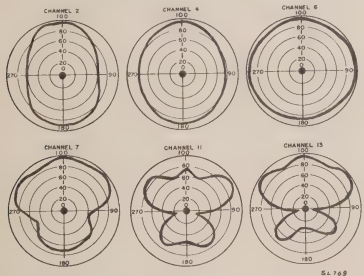


Fig. 66—Stacked "V"—VHF Horizontal Field Patterns

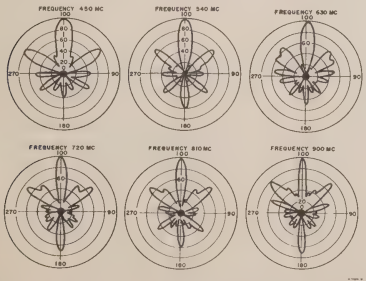


Fig. 67—Stacked "V"—UHF Horizontal Field Patterns

Triangular Dipole ("Bow Tie")

The Triangular Dipole, figure 68, is an inexpensive antenna which is considered flexible in operation because of the many ways it may be used. This antenna may be used singly, in pairs, without reflectors or with reflectors. Stacking the dipoles increases gain and adding reflectors provides unidirectional characteristics. The Triangular Dipole is a very rigid antenna and small in size. Operation at the VHF frequencies is only fair but in strong signal areas it could be used for combination VHF-UHF operation provided no reflection problems are encountered. Characteristics of this antenna are shown in figures 68 through 71.

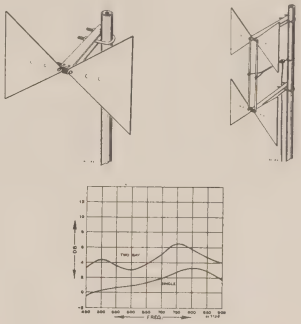


Fig. 68—Triangular Dipole—Single and Stacked—With Gain Curves

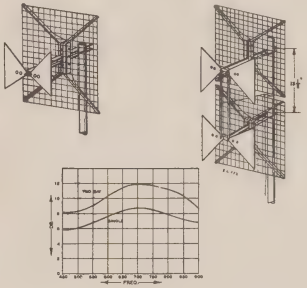


Fig. 69—Triangular Dipoles—With Reflectors—Showing Gain Curves

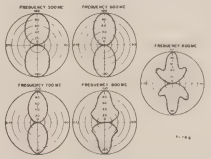


Fig. 70—Triangular Dipole—Single Bay Horizontal Field Patterns

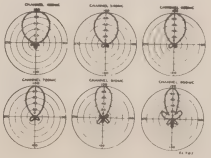


Fig. 71—Triangular Dipole—Single Bay with Reflector Horizontal Field Patterns

Yagi

The Yagi antenna illustrated in figure 72 is useful in the UHF spectrum as well as in the VHF band. The gain of this antenna is exceptionally high and it has a narrow band characteristic. The gain curve and horizontal field pattern are shown in figures 72 and 73. The Yagi is a high performance antenna with respect to reflection elimination and unwanted signal reduction. Also, in areas where there is only one UHF channel and the receiver is in a fringe section, this antenna would provide the high gain necessary for good reception. These antennas may be "stacked" to provide even higher gain. In general, the Yagi is considered a "one-station" antenna and for this reason its use will be limited compared to the types previously described.

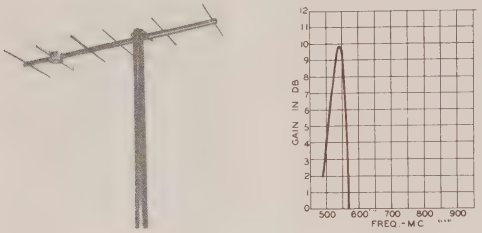


Fig. 72—Six Element Yagi—With Gain Curve

Fig. 73—Yagi Horizontal Field Pattern

Transmission Lines and Antenna Matching

Selection of Transmission Line

A few of the characteristics of five commonly used transmission lines are given here to simplify the selection of a line for a particular installation. Two important factors which influence the selection are impedance matching and line loss.

Impedance matching usually presents no major problems. Basically, either a 72-ohm or a 300-ohm impedance input is used at the receiver. The 300-ohm is more common. The impedance of the line selected, therefore, should be approximately 72 ohms or 300 ohms. Most of the lines have an impedance which approximates either value. If an impedance transformation is found necessary, a balun, like those shown in figures 77 and 78, may be used.

The line loss will probably receive the greatest consideration in the selection of a type of transmission line. In addition to the usual conductor and dielectric losses, other factors have to be considered. One factor of major importance is the exposure of the line to all kinds of weather and atmospheric conditions. Another factor is the placement or run of the line. Each will be considered for its effects on the line loss.

Line Characteristics

300-Ohm Twin Lead—This type of line shown in figure 74, is most commonly used in VHF installations. Its characteristic impedance is 300 ohms. At 100 mc. the line loss is 1.1 db per 100 feet. See figure 75. When the line is moist or is lying along a conductive surface, the loss on high VHF channels may increase to as much as 5 db per 100 feet. Because of this difficulty, it is an impractical line for use on UHF installations since the loss is even greater at UHF. Although the loss at 600 mc. is 3 db per 100 feet when the line is dry, the loss may be over 10 db per 100 feet at 600 mc. when the line is wet.

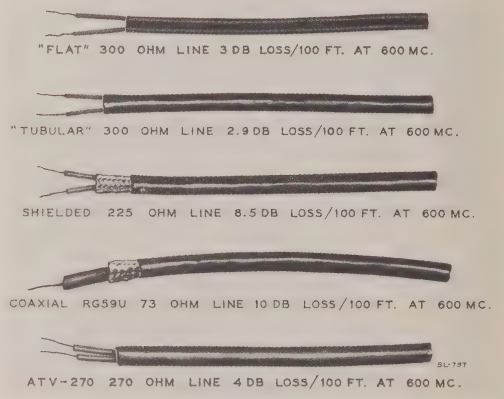

"FLAT" 300 OHM LINE 3 DB LOSS/100 FT. AT 600 MC.
"TUBULAR" 300 OHM LINE 2.9 DB LOSS/100 FT. AT 600 MC.
SHIELDED 225 OHM LINE 8.5 DB LOSS/100 FT. AT 600 MC.
COAXIAL RG59U 73 OHM LINE 10 DB LOSS/100 FT. AT 600 MC.
ATV-270 270 OHM LINE 4 DB LOSS/100 FT. AT 600 MC.

Fig. 74—Transmission Line Losses at 600 MC.

300-Ohm Tubular—The tubular twin lead, figure 74, is used in both VHF and UHF installations. Its impedance is approximately 300 ohms. The conductors are molded into the wall of a round polythylene tube. The resultant air space between the conductors makes the loss of this line slightly lower than the loss of flat twin lead. See figure 75.

This construction also affords protection against weather and atmospheric conditions. Such deposits on the line as moisture, salt or soot will not increase the dielectric loss to the extent that occurs on flat twin lead. The requirements of a good line run are not as critical for tubular as they are for flat twin lead.

The main requirements for using tubular are that the ends of the line be sealed and that a drip loop with a drainage hole be made at the lowest extremity of the line. This will provide a seal against the entry of moisture and foreign particles and a drain for possible condensation within the tube.

ATV-270—The ATV-270 (figure 74) comprises a balanced line with a 270-ohm impedance. The line was developed primarily for UHF installations where losses due to moisture, salt and dirt are important factors.

Each conductor is enclosed in a $\frac{1}{8}$-inch polyethylene tube and both tubes are enclosed in a vinylite sheath approximately $\frac{1}{2}$ inch by $\frac{3}{8}$ inch in cross-section. With this construction the ATV-270 provides more protection and, consequently, has only a fraction of the loss of other lines used at the present time, when exposed to moisture, salt and dirt.

225-Ohm Shielded—The shielded line (figure 74) has an impedance of 225 ohms. It is similar in construction to the ATV-270 but the shielded line has an additional copper braid (or aluminum foil) surrounding both insulated conductors. Because of the tubular construction, it is necessary to seal the ends of the line against the entry of water and to make a drain loop at the lowest point in the line run.

The loss of the shielded line is about 8.5 db per 100 feet at 600 mc. Since this is considerably greater than the loss for tubular or twin lead, the line is recommended for use in strong signal areas. In these areas, the shield would provide the benefits of reducing interference and reflection pickup. The shield is usually grounded at the receiver.

RG59U Coaxial—The RG59U (figure 74) coaxial line has an impedance of 72 ohms. Its high attenuation loss limits its use to strong signal areas. At 600 mc., there is a 10 db loss per 100 feet.

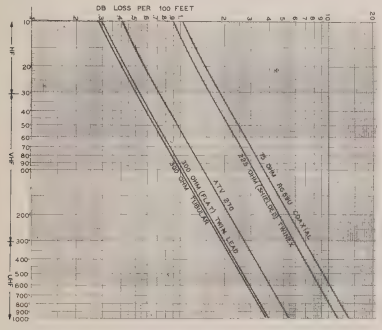


Fig. 75—Loss vs. Frequency for Five Types of Transmission Lines

The shielding effect of the coaxial line offers good protection against stray pickup. There is little restriction, too, on where the line can be run. No adverse weather effects are found when using the coaxial line.

Baluns

For some installations, a 300-ohm input or output impedance will have to be transformed to 72 ohms, and a 72-ohm impedance to 300 ohms. This transformation is effected through the use of a balun. As an example, if a coaxial transmission line is used for an installation, a balun can be employed at the antenna terminals to effect a match to the line. A balun can also be employed at the receiver input if the 72-ohm line impedance has to be matched to a 300-ohm receiver-input impedance.

The characteristics of three kinds of balun units are given here to simplify the application of each kind to a particular installation.

The KRK-23 balun (figure 76) is prefabricated from 150-ohm and 300-ohm twin lead and incorporates a high-pass filter. It is available through RCA Victor distributors. This balun is used primarily with the U1 Selector where a 300-ohm UHF-VHF line is to be matched to the 72-ohm UHF input. The high-pass filter prevents VHF signal from entering the selector.

The loss of the KRK-23 balun varies from 1.4 db at 450 mc. to 3.3 db at 900 mc.

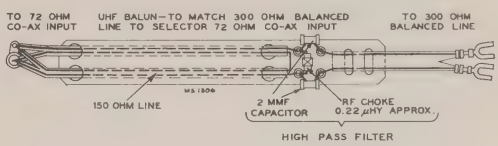
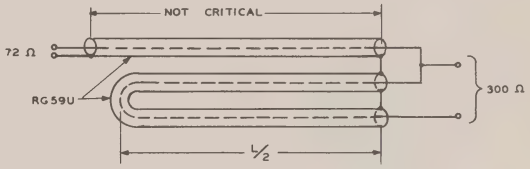

TO 72 OHM CO-AX INPUT
UHF BALUN—TO MATCH 300 OHM BALANCED LINE TO SELECTOR 72 OHM CO-AX INPUT
TO 300 OHM BALANCED LINE
MS-1306
150 OHM LINE
2 MMF CAPACITOR
RF CHOKE 0.22 μHY APPROX.
HIGH PASS FILTER

Fig. 76—UHF Balun—KRK-23

For most UHF impedance transformations, the coaxial balun (figure 77) is a widely-used type because of the availability of RG11U or RG59U coaxial cable. The loss of this balun is about 1.3 db at frequencies above and below that frequency to which the line is cut, and about 0.6 db at the resonant frequency. The coaxial balun is more suitable than a twin lead balun for outdoor use, at the antenna terminals, because the coaxial cable is less susceptible to weather and atmospheric conditions.



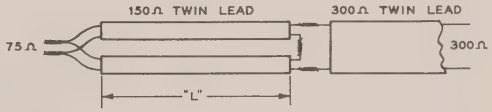
CHANNEL NOS.	14-25	26-35	36-45	46-55	56-65	66-75	76-85
L (INCHES)	8½	7½	6¾	6	5½	5	4¾

LET L= 5½ INCHES FOR GENERAL USE

Fig. 77—UHF Coaxial Balun

The twin lead balun (figure 78) can be made from 150-ohm twin lead, if it is available. Losses for this balun are similar to those for the coaxial balun. It's use would be limited to indoor applications.

All three baluns are recommended for UHF installations but not for VHF because of the cumbersome lengths of leads required for VHF.



CHANNEL NOS.	14-24	25-47	48-71	72-83
"L" (INCHES)	5½	4⅛	3⅓	2¾

LET "L"= 4⅛ INCHES FOR GENERAL USE.

Fig. 78—UHF Twin Lead Balun

Crossover Network

The crossover network (figures 79 and 80) is an impedance matching device which couples separate UHF and VHF 300-ohm lines to a common 300-ohm line. Such a network is highly recommended for antenna installations where the UHF antenna is mounted on the VHF antenna mast.

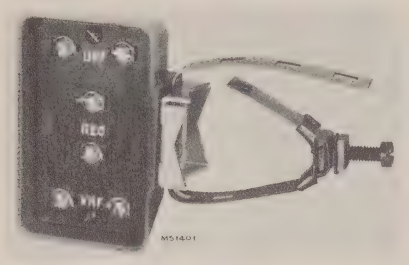


Fig. 79—UHF-VHF Antenna Crossover Network

The network can be mounted on either a cross-arm or on the mast in proximity of both antennas. The terminal board on the network must face downward for best weather protection. A 300-ohm line is run from both antennas to their respective terminal screws on the terminal board, marked "UHF" and "VHF." A third 300-ohm line is run from the terminals marked "REC," to the input terminals of the receiver.

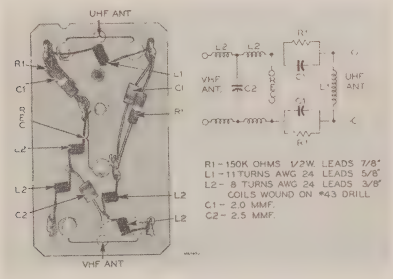


Fig. 80—Crossover Network—Bottom View and Schematic

The crossover network will no doubt prove valuable in many UHF-VHF antenna installations because only a single 300-ohm transmission line is required from the UHF-VHF antenna system to the television instrument. Also, both antennas can be placed on a single mast. The benefits of simplicity, economy and time-saving are apparent. Several applications of the crossover network are shown in the Appendix.

SUMMARY

An attempt has been made to include in this lecture booklet, information concerning UHF television which will simplify installation and service practices and enable the serviceman to give his customers the best possible television reception. These practices include everything from the initial selection of an antenna to the final adjustment of the television instrument.

The antenna could be ranked the most important factor in obtaining good UHF reception, for here lies the means of establishing the highest possible signal-to-noise ratio in the system. The important factors to be considered for a good UHF installation are as follows:

1. Selection of an antenna
2. Antenna location
3. Antenna orientation
4. Suitable transmission line
5. Line match to antenna and instrument

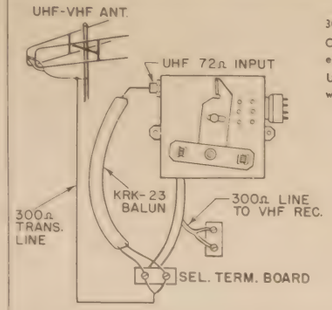
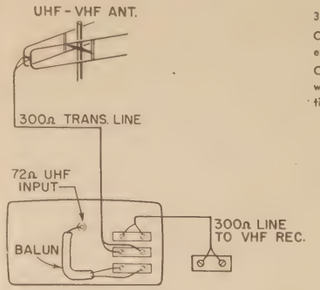
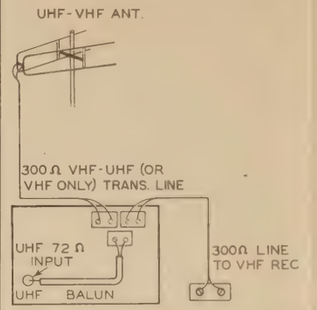
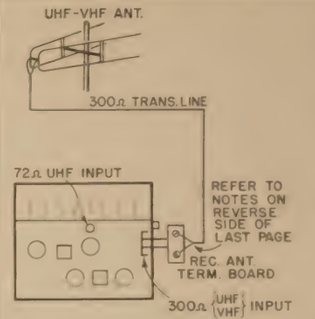
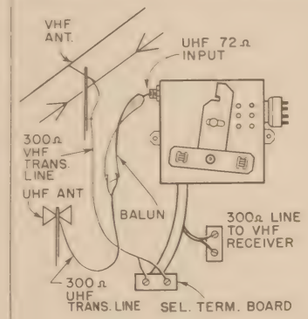
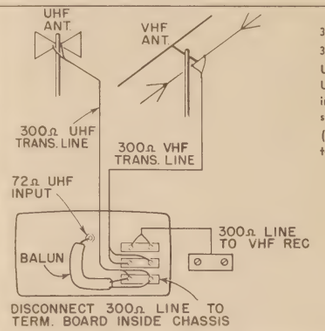
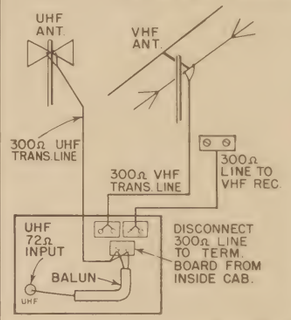
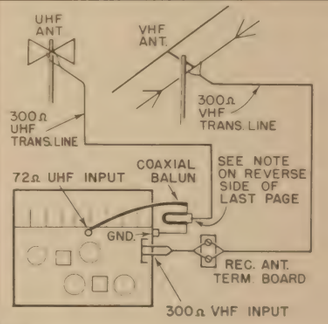
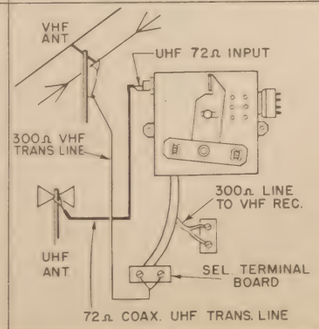
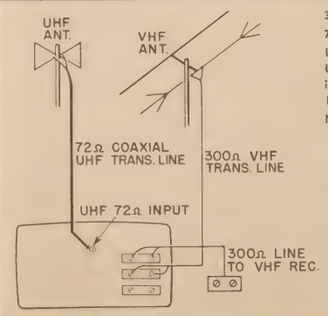
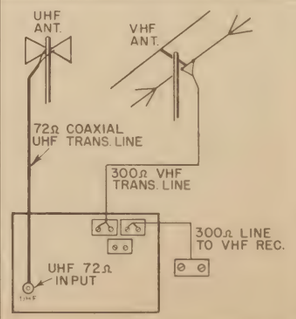
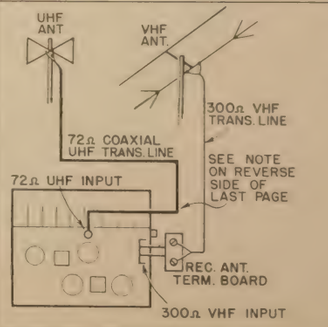
Another important factor established in obtaining good UHF reception is the proper installation and adjustment of the UHF selector or the VHF-UHF receiver. Because adjustments on UHF instruments are more critical than on VHF instruments, the serviceman must be more exact in his methods to obtain a good picture. This does not mean, necessarily, spending more time making adjustments, but simply observing more caution so that repetitious adjustments are minimized.

A comprehensive circuit description of each UHF instrument has been given to enhance the serviceman's knowledge of the instruments and to aid him when service on these instruments is necessary.

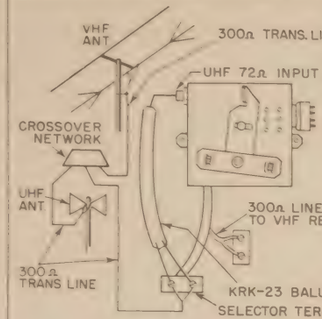
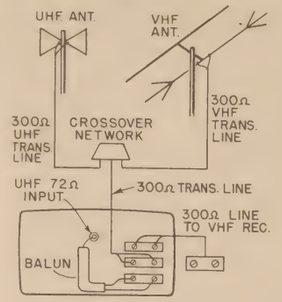
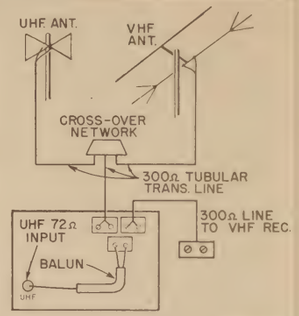
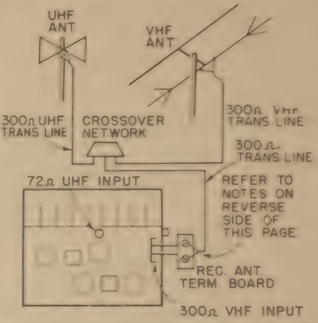
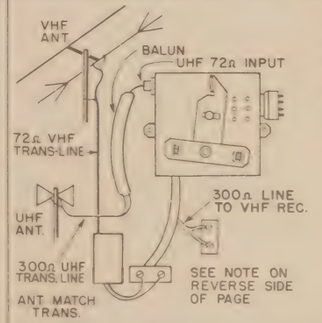
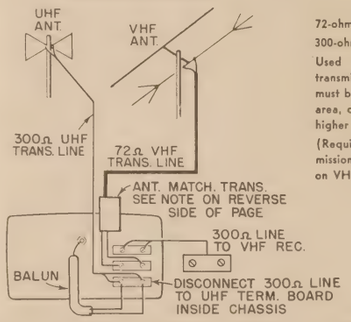
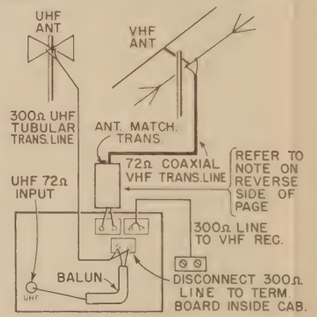
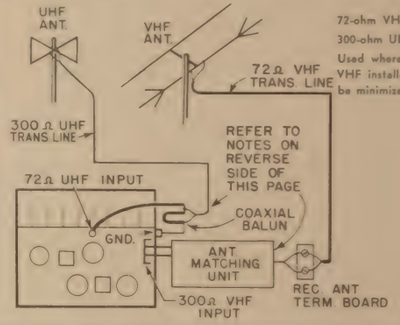
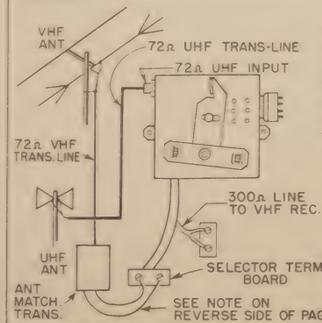
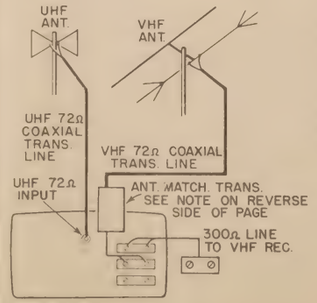
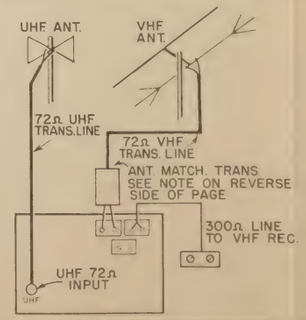
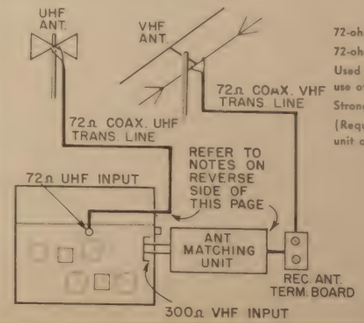
Many photographs and drawings have been provided throughout this booklet to supplement the descriptive material and to simplify the installation, alignment, and servicing of these instruments.

Included in the Appendix is a summary of typical antenna installations and connections to the television instruments described in this publication.

APPENDIX

INSTALLATION CONDITIONS	TRANSMISSION LINE CONNECTIONS FOR U1 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR U2 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR U70 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR KRK12 TUNER (KRK25 KIT)
CONDITION 1 UHF/VHF ANTENNA USING 300-OHM TRANSMISSION LINE.	 300-ohm transmission line. Combination UHF-VHF antenna (or existing VHF antenna). Used in single UHF channel areas where UHF signal is very strong.	 300-ohm transmission line. Combination UHF-VHF antenna (or existing VHF antenna.) Can be used in 2 station (UHF) areas where both stations (plus VHF stations) provide good signals.	 300-ohm transmission line. Combination VHF-UHF antenna (or existing VHF antenna.) Can be used in multi-station areas where reception is good on all VHF channels.	 300-ohm transmission line. Common UHF-VHF antenna. Used where existing VHF antenna provides good reception on VHF and UHF. Tubular 300-ohm transmission line is recommended to minimize line losses for UHF.
CONDITION 2 VHF ANTENNA HAS 300-OHM TRANSMISSION LINE. UHF ANTENNA ADDED USING 300-OHM TRANSMISSION LINE.	 300-ohm UHF transmission line. 300-ohm VHF transmission line. Used in single UHF channel area where UHF installation added to existing VHF installation. (Use tubular transmission line on UHF to minimize line loss.)	 300-ohm VHF transmission line. 300-ohm UHF transmission line. Used in 2 station (UHF) areas where UHF antenna is added to existing VHF installation (or for higher gain in a 1 station UHF area.) (Use tubular transmission line on UHF to minimize line loss.)	 300-ohm VHF transmission line. 300-ohm UHF transmission line. Used in multi-station area where UHF installation added to existing VHF installation. (Use tubular transmission line on UHF to minimize line loss.)	 300-ohm VHF transmission line. 300-ohm UHF transmission line. Used where UHF antenna added to VHF installation and separate 300-ohm transmission line used for UHF. Requires coaxial balun between UHF 300-ohm transmission line and 72-ohm UHF input.
CONDITION 3 VHF ANTENNA HAS 300-OHM TRANSMISSION LINE. UHF ANTENNA ADDED USING 72-OHM COAXIAL TRANSMISSION LINE.	 72-ohm UHF transmission line. 300-ohm VHF transmission line. Used in single UHF channel area where UHF installation added to existing VHF installation. (No balun required.)	 300-ohm VHF transmission line. 72-ohm UHF transmission line. Used in 2 station (UHF) areas where UHF antenna added to existing VHF installation (or for higher gain in a 1 station UHF area.) No balun required.	 300-ohm VHF transmission line. 72-ohm UHF transmission line. Used in multi-station areas where UHF installation added to existing VHF installation. (No balun needed.)	 300-ohm VHF transmission line. 72-ohm UHF transmission line. Used where strong UHF signals available in installations where UHF antenna added to VHF installation.

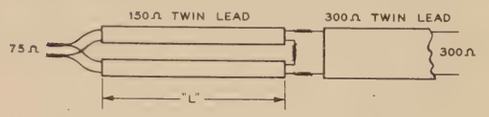
APPENDIX

INSTALLATION CONDITIONS	TRANSMISSION LINE CONNECTIONS FOR U1 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR U2 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR U70 SELECTOR	TRANSMISSION LINE CONNECTIONS FOR KRK12 TUNER (KRK25 KIT)
CONDITION 4 VHF ANTENNA HAS 300-OHM TRANSMISSION LINE. UHF ANTENNA ADDED WITH 300-OHM TRANSMISSION LINE. CROSSOVER NETWORK ADDED. ONLY ONE TRANSMISSION LINE TO RECEIVER REQUIRED. (TUBULAR TRANSMISSION LINE RECOMMENDED)	 Common UHF-VHF 300-ohm transmission line. Used in single UHF channel area where UHF antenna added to existing VHF installation. Crossover network eliminates separate UHF-VHF line runs.	 300-ohm transmission line and crossover network. Used where UHF installation added to a VHF installation. Crossover network eliminates double line-run. Both antennas and crossover network may be mounted on same mast. 300-ohm tubular transmission line recommended. Used in 2 station (UHF) areas. Useful in 1 station (UHF) area where higher gain required.	 Common 300-ohm transmission line. Used in multi-station area where separate UHF antenna added to VHF installation. Crossover network eliminates separate VHF-UHF line runs.	 300-ohm common transmission line and crossover network. Used where UHF antenna added to VHF installation. Crossover network eliminates separate transmission line for UHF and VHF. 300-ohm tubular transmission line recommended to minimize line loss for UHF.
CONDITION 5 VHF INSTALLATION HAS 72-OHM COAXIAL TRANSMISSION LINE. UHF INSTALLATION ADDED USING 300-OHM TRANSMISSION LINE.	 72-ohm VHF transmission line. 300-ohm UHF transmission line. Used in single UHF channel area where VHF requires coaxial line, and UHF line losses must be minimized. (Requires use of balun on UHF transmission line and matching transformer on VHF transmission line).	 72-ohm VHF transmission line. 300-ohm UHF transmission line. Used where VHF requires coaxial transmission line and UHF line losses must be minimized in 2 station (UHF) area, or 1 station (UHF) area where higher UHF gain required. (Requires use of balun on UHF transmission line and matching transformer on VHF transmission line).	 72-ohm VHF transmission line. 300-ohm UHF transmission line. Used in multi-station area where VHF requires coaxial line and UHF line losses must be minimized. (Requires antenna matching transformer on VHF transmission line).	 72-ohm VHF transmission line. 300-ohm UHF transmission line. Used where coaxial line required for VHF installation and line losses must be minimized for UHF.
CONDITION 6 VHF INSTALLATION HAS 72-OHM COAXIAL TRANSMISSION LINE. UHF ANTENNA USING 72-OHM COAXIAL TRANSMISSION LINE ADDED.	 72-ohm VHF transmission line. 72-ohm UHF transmission line. Used where VHF requires use of coaxial line. Single UHF channel has strong signal. (Requires antenna matching transformer on VHF transmission line).	 72-ohm VHF transmission line. 72-ohm UHF transmission line. Used in 2 station (UHF) area where VHF reception requires use of coaxial line. Strong UHF signals available. (Requires antenna matching transformer on VHF transmission line)	 72-ohm VHF transmission line. 72-ohm UHF transmission line. Used in multi-station areas where VHF reception requires use of coaxial line. Strong UHF signals available. (Requires antenna matching transformer on VHF transmission line)	 72-ohm VHF transmission line. 72-ohm UHF transmission line. Used where VHF reception requires use of coaxial line. Strong UHF signals available. (Requires use of antenna matching unit on VHF transmission line at set.)

NOTES

For 300-ohm/72-ohm Antenna Matching

Balanced 300-ohm transmission line from a separate UHF antenna may be connected to the unbalanced 72-ohm UHF input (or vice-versa) through an impedance-matching device such as a balun. Three types of baluns are illlustrated below. For general use, dimensions can be as shown. Twin lead and coaxial baluns may be constructed by the Service Technician from information given. The KRK-23 unit, available through RCA Victor Distributors, incorporates a high-pass filter network for additional protection from VHF interference.

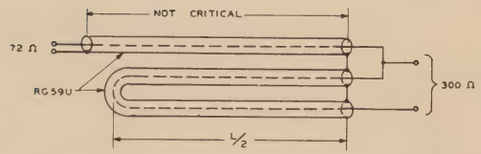


CHANNEL NOS.	14-24	25-47	48-71	72-83
"L" (INCHES)	5 1/2	4 1/8	3 1/3	2 3/4

LET "L" = 4 1/8 INCHES FOR GENERAL USE.

MS-1406

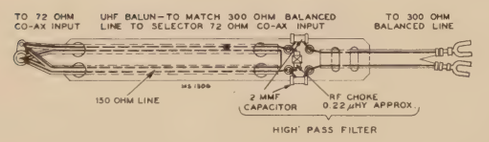
TWIN LEAD BALUN



CHANNEL NOS.	14-25	26-35	36-45	46-55	56-65	66-75	76-85
L (INCHES)	8½	7½	6¾	6	5½	5	4¾

LET L = 5½ INCHES FOR GENERAL USE

COAXIAL BALUN

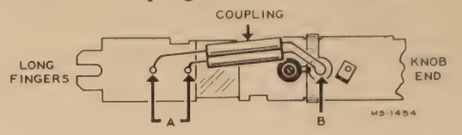

TO 72 OHM CO-AX INPUT
UHF BALUN—TO MATCH 300 OHM BALANCED LINE TO SELECTOR 72 OHM CO-AX INPUT
TO 300 OHM BALANCED LINE
MS-1309
150 OHM LINE
2 MMF CAPACITOR
RF CHOKE 0.22 μHY APPROX
HIGH PASS FILTER

UHF BALUN – KRK 23

For UHF Insert Using 72-ohm Input

UHF station inserts provide for operation with either separate antennas for UHF and VHF, or a common UHF-VHF antenna. If separate antennas for UHF and VHF are to be used, the antenna coupling loop must be removed from each UHF insert, as shown below. Cut the wires at the contact buttons (A) to which they are soldered, unwrap tape securing coupling to the insert, and carefully remove the loop (B) from inside the spiral-wound coil by rotating it until it slips out easily.

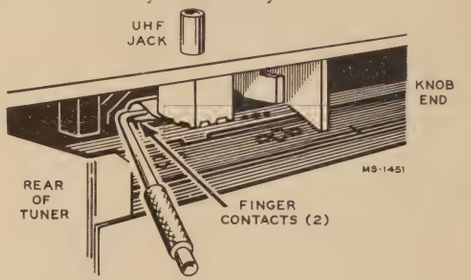
If a common UHF-VHF antenna is to be used, this antenna coupling must not be disturbed.



300Ω INPUT ON UHF INSERT

For Disabling 72-ohm UHF Input

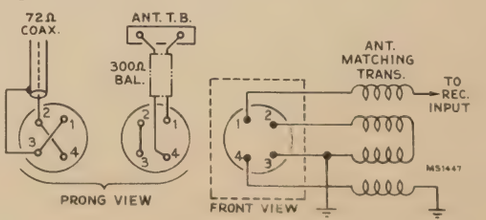
It may be desirable with weak signal reception, when using a common UHF-VHF antenna lead-in, to bend the contact finger of the separate UHF input jack to clear the insert contact buttons. Turn the Channel Selector knob until an empty drum compartment is in line with these fingers. Then, by reaching under the edge of the shelf with a probe, bend the contact fingers to clear the contact buttons of the insert. Touch-up adjustments on the UHF inserts may be necessary.



DISABLING 72Ω UHF INPUT ON KRK-12

For Using Antenna Matching Transformer on VHF Input

A schematic diagram of the antenna matching transformer, Stock No. 73578, is shown below. This transformer, or its equivalent, is recommended for use where a 72-ohm unbalanced VHF transmission line is to be matched to a 300-ohm balanced input. The proper connections at the plug for a 72-ohm input should be observed.



ANTENNA MATCHING UNIT

RCA